Department for Communities and Local Government

English Housing Survey
TECHNICAL REPORT 2012-13

ENGLISH HOUSING SURVEY

Department for
Communities and
Local Government

English Housing Survey:
TECHNICAL REPORT 2012-13

July 2014
Department for Communities and Local Government

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Content

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- The NatCen interviewers who conducted the household interviews and the CADS Housing Surveys surveyors who carried out the visual inspections of properties.
- And finally, the team at DCLG who worked on the survey and who were involved in the production of this report.

Chapter 1
Sampling

The English Housing Survey (EHS) consists of two main elements: an initial interview survey of approximately 13,300 households and a follow up physical inspection of a sub-sample of around 6,200 of dwellings which includes vacant dwellings. This chapter provides information on how household and dwelling samples were selected for inclusion in the interview and physical survey elements of the 2012-13 EHS.

Overview

1.1 As in previous years, addresses for the initial 2012-13 EHS sample were selected using a systematic random sample design. Interviews are attempted at all of these addresses. This is the 'household sample', also referred to throughout this report as the 'interview survey sample'.

1.2 Unlike previous years, the design was changed in 2012-13 so that the sample was clustered, with interviewing carried out in alternate halves of England in each year. This design delivers a representative sample of households in England for any year, with the sample being unclustered for any two combined years of the survey.

1.3 In addition to the household sample, a sub-sample of addresses is then selected for physical inspection by a qualified surveyor. This sub-sample includes both occupied and vacant dwellings and is referred to as the 'dwelling sample' or 'physical survey sample'. To ensure a sufficient number of rented properties are included in the dwelling sample, all rented properties are selected for physical inspection while about 50% of owner occupied dwellings are randomly selected for a physical inspection (the percentage selected varied by quarter of the survey, ranging from 42% to 55%).

1.4 In 2012-13, 25,286 addresses were issued to interviewers. A small proportion of these were found to be ineligible, including addresses that were found to be commercial premises, second and holiday homes or demolished properties. Of the remainder, interviews were achieved at 13,652 addresses. A further 1,112 addresses were found to be vacant. After sub-sampling, 10,415 dwellings were passed to surveyors, and physical surveys were achieved at 6,304 of these.

Interview survey sample

1.5 The requirement for the 2012-13 household sample was to achieve 13,300 interviews across the four housing tenures (i.e. owner occupied, private rented, local authority and housing association).

1.6 To achieve these interviews, an initial sample of 36,000 addresses was drawn from the Postcode Address File (PAF). These addresses were drawn as a systematic two-stage random sample from the Royal Mail's Small User PAF.

1.7 For the first stage of sampling, 1,808 geographic 'merged areas' were generated by combining neighbouring Lower Layer Super Output Areas (LSOAs), so that each 'merged area' contained about 12,500 addresses. Half (904) of these 'merged areas' were randomly selected (as a systematic stratified sample) for the 2012-13 sample, with the remaining half then allocated for the 2013-14 sample.

1.8 The second stage of sampling involved selecting a stratified systematic random sample of addresses within the 'merged areas' selected for the 2012-13 sample.

1.9 The advantage of this two-stage approach is that it reduces the fieldwork area to half the country so interviewer and surveyor travel time and costs are reduced. The disadvantage is that for any single survey year the survey is partially clustered, which will result in a small loss[1] in statistical efficiency. However, when analysing any two years of survey data the combined sample is entirely unclustered.

1.10 For each sampled address, the predominant tenure within the postcode that contained that address was identified and attached to the record. Predominant tenure was identified using Experian's Residata[2] classifications; addresses were then grouped into strata and sub-sampled at the rates of 63% for owner occupied, 68% for private rented and 100% for social rented. As a result, 25,286 addresses were issued to interviewers, Table 1.1.

[1] NatCen estimate that the maximum design factor for standard errors would be around 1.14.
[2] Experian possess a database that contains information obtained from a number of sources including insurance companies, Census, etc. referred to as Residata. It is from this that information is taken on predominant tenure within a postcode as well as other information. The matching of the EHS sample to Residata is carried out by BRE.

Table 1.1: Sub-sampling of PAF addresses, 2012-13

	PAF sample	Sub-sampling rate	Issued EHS sample
	addresses	*percentages*	*addresses*
predominant tenure			
owner occupied	25,361	62.8%	15,919
private rented	3,935	67.7%	2,663
social rented	6,547	100.0%	6,547
unknown tenure	157	100.0%	157
Total	**36,000**	**70.2%**	**25,286**

1.11 Interviews were achieved at 13,652 households, Table 1.2.

Table 1.2: Number of interviews achieved, 2012-13

tenure	
owner occupiers	8,280
private rented	2,103
local authority	1,523
housing association	1,746
Total	**13,652**

Physical survey sample

1.12 The requirement for the 2012-13 physical survey sample was 6,200 physical surveys across the four housing tenures.

1.13 To ensure that the EHS delivers the same level of precision as its predecessor the English House Condition Survey (which was based on a clustered sample design), the EHS sample is stratified to ensure disproportionate numbers of renters are included, Table 1.3. The alternative would be to issue a very much larger random sample and carry out unnecessary owner occupier surveys in order to accumulate sufficient renting cases.

Table 1.3: Tenure distribution of achieved physical survey sample compared with the national stock

	Achieved sample		National stock
	number	*percentages*	*percentages*
tenure			
owner occupiers	2,640	42.0%	65.0%
private rented	1,295	21.0%	18.0%
local authority	1,120	18.0%	10.0%
housing association	1,249	20.0%	8.0%
Total	**6,304**	**100**	**100**

1.14 The issued sample for the physical survey is drawn as a stratified sub-sample of the dwellings of those households who respond to the interview survey, together with a stratified sub-sample of dwellings found to be vacant at that stage. Calculation of the size of the sample to be issued takes account of the expected physical survey response rates by tenure.

1.15 The sub-sampling of interview survey cases for the physical survey is carried out in the field during the interview, using the tenure of the dwelling established during the interview. Interviewers are advised via the CAPI (computer-aided personal interviewing) instrument if the household they are interviewing is eligible for the physical survey, and if so they then attempt to gain agreement from respondents to take part before passing on the address details to CADS Housing Surveys.

1.16 Different sub-sampling rates are applied to each tenure group to identify cases eligible for the physical survey. These rates can be varied quarterly if required in order to achieve the required annual total sample.

1.17 Because the rented sector is smaller than the owner occupied sector, the rented sector is over-sampled to ensure sufficient numbers for analysis. Sub-sampling rates are reviewed at the start of each year and are kept under review throughout the year in order to ensure a sufficiently large sample is achieved. The sub-sampling rates for 2012-13 are shown in Table 1.4.

Table 1.4: Sub-sampling rates, 2012-13 physical survey

	Sub-sample rates			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
				percentages
tenure				
owner occupiers	41.7%	50.0%	55.0%	55.0%
private rented	100.0%	100.0%	100.0%	100.0%
local authority	100.0%	100.0%	100.0%	100.0%
housing association	100.0%	100.0%	100.0%	100.0%

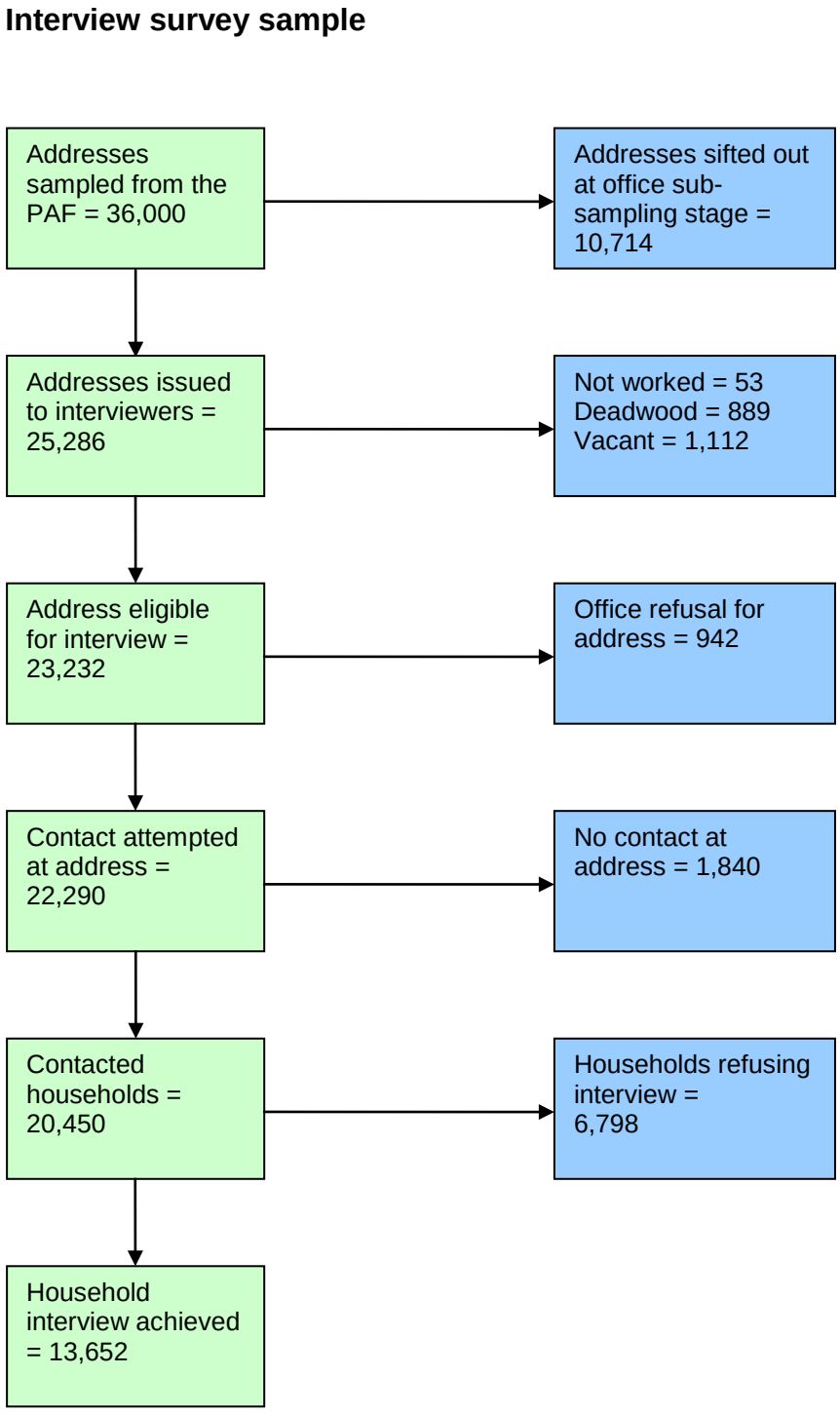
1.18 The aim was to keep the rate fairly constant. This was to ensure that there were roughly equal numbers of surveys across the quarters to reduce the impact of seasonality (for example, damp problems are more likely to be identified in the winter). In practice the sub-sample rate for owner occupiers was increased from 42% to 55% from quarter 1 to quarter 4. The increase in the sub-sample rate was required because of a systematic change in the accuracy of Experian's Residata from the previous year's database.

1.19 Vacant properties are sub-sampled at the same rates as occupied cases based on their last known tenure gathered by interviewers as part of their initial visit. For vacant properties, cases are selected for physical survey based on the interviewer's best estimate of tenure using local enquiries. Permission and access for the survey is then sought by CADS Housing Surveys surveyors.

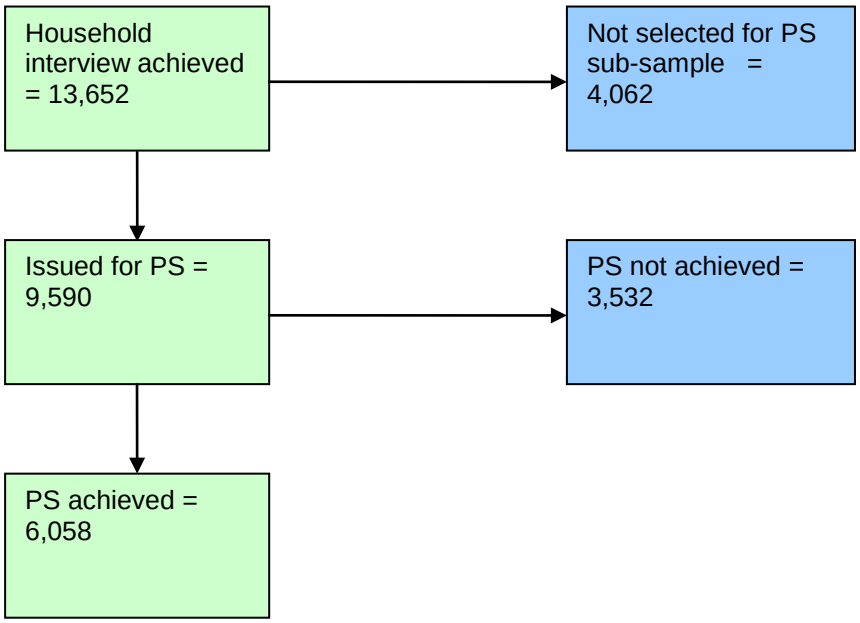
1.20 Not surprisingly, a lower proportion of full physical surveys are obtained in unoccupied dwellings, compared with occupied dwellings, because of the difficulty in gaining access to a property that is currently unoccupied. In 2012-13, surveyors managed to gain access and obtain full physical surveys in 30% of dwellings that were unoccupied at the time of interview. This is a decrease from 35% in 2011-12.

1.21 The 2012-13 sampling and response process is summarised below, Figure 1.1.

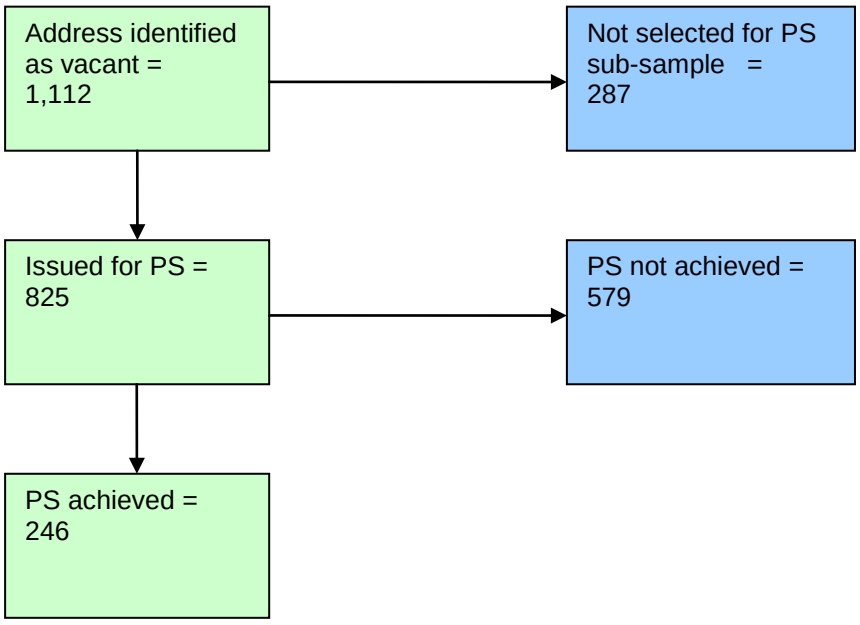
Figure 1.1: Sample structure of the EHS, 2012-13



Physical survey sample: occupied dwellings



Physical survey sample: vacant dwellings



Sampling at addresses

1.22 Most addresses contain a single dwelling and single household. However, at a small proportion of addresses (less than 1%) this is not the case. There are standard procedures for interviewers to randomly select one dwelling and/or one household when more than one is identified.

1.23 Considering dwellings, the procedure is for the interviewer to list the dwellings identified at the address and then randomly select one from the list, using a pre-selected random number. The random number is obtained from a sheet (called a Kish grid) which has a column of the number of dwellings identified, and a column of which numbered dwelling to select.

1.24 The same procedure is used to select the household to interview when more than one is identified at a dwelling/address.

Chapter 2
Questionnaires

The English Housing Survey (EHS) collects data in two separate phases. In the first phase an interviewer visits a sampled address and conducts a face-to-face interview, using a questionnaire that is administered using computer assisted personal interviewing (CAPI). Following the interview a second phase of data collection occurs when, for a sub-sample of cases, a qualified surveyor visits the address to make an assessment of the fabric and condition of the home. The surveyor completes a detailed physical survey form using a digital pen.

Overview

2.1 Each year the relevance of the data collected by the interview questionnaire and surveyor form is reviewed. Questions are revised if they are found to deliver poor quality data, or removed altogether if the information they elicit is no longer relevant to users' needs. In addition, established blocks of questions are periodically rotated in and out of the questionnaire. This makes room for the inclusion of new questions to capture data on emerging trends and new government policy.

2.2 The annual questionnaire review is led by the Department for Communities and Local Government (DCLG) in consultation with the Department for Energy and Climate Change (DECC) and key survey users across both departments.

2.3 While the content of the physical survey has remained largely unchanged from the former English House Condition Survey (EHCS), the interview questionnaire has undergone more significant changes since its inception in 2008-09. More details on the content and annual review of the questionnaire and survey form are provided below.

Interview questionnaire

2.4 A core set of questions is retained in the interview questionnaire each year. These questions cover:

- household composition, ethnicity, nationality, economic status, education and health

- household accommodation and length of residence
- housing history and aspirations
- rent and mortgage payments
- satisfaction with landlord/attitudes to neighbourhood
- income

2.5 These topics cover the key attributes of a household and the dwelling it resides in. The permanent inclusion of questions on these topics (with minimal change to the phrasing of the questions) ensures a consistent picture is provided over time.

2.6 The questionnaire also contains a number of rotating question sets which come in and out of the survey on an annual or biennial basis (or in some cases, less frequently). Topics covered in these modules include:

- second homes
- fire and fire safety
- satisfaction with the neighbourhood
- work undertaken to improve energy efficiency of the home
- adaptations made to the home to improve accessibility
- tenancy deposits

2.7 The content of the interview survey is reviewed annually. In 2011-12, a fairly radical overhaul of the questionnaire was undertaken. This was driven by a significant reduction in funding and the consequent requirement to reduce the length of the questionnaire from 50 to 30 minutes. By comparison, changes to the interview questionnaire between 2011-12 and 2012-13 were relatively minor.

2.8 The main changes that were made to the 2012-13 questionnaire were:

- questions on second homes were rotated onto the questionnaire
- questions on disability and adaptations to the home and tenancy deposits were rotated out of the questionnaire
- wording changes were introduced to account for the fact that the questionnaire was no longer part of the Integrated Household Survey
- more guidance to interviewers on a number of questions was built into the interviewer (CAPI) programme (accessed via an on-screen help facility). This included guidance on tenure and landlord, type of accommodation, mortgages and employment
- questions on marital status and long-standing illness or disability were updated to reflect changes to Office for National Statistics (ONS) harmonised questions; questions on agency working were also included for the same reason
- the question on highest education level was simplified

- a number of other minor wording changes were made to improve comprehension of questions

2.9 The 2012-13 questionnaire covered the following topics:

- demographics: including age, sex, marital status, household reference person and household relationships
- accommodation
- tenure
- individual characteristics including nationality, country of birth, ethnicity, time at address, health and disability, education
- age of accommodation
- housing history
- subletting
- waiting lists (for social housing)
- rooms available to the household and shared facilities
- type of dwelling and household
- satisfaction with accommodation and neighbourhood
- access to vehicles
- council tax and utilities
- energy efficiency
- ownership type (i.e. leasehold or freehold)
- satisfaction with repairs and maintenance
- ownership details
- mortgages including type, payments and arrears
- tenancy type
- social renting details
- rent and housing benefit including payments and arrears
- number of tenancy agreements
- energy performance certificate
- fire safety
- second homes
- buying aspirations
- working status and job details
- economic status
- Income and earnings
- benefits
- income support and mortgage interest
- savings and investments

2.10 The full EHS 2012-13 questionnaire is published on the DCLG website: https://www.gov.uk/government/publications/english-housing-survey-questionnaires.

2.11 In 2012-13, the median interview length including recruitment to the physical survey was 37 minutes. This length is calculated on full interviews only; partial

interviews are excluded. A partial interview is when a substantial part of the interview is carried out (up to QBuyAsp.PlanTen) but the interview is stopped before the end is reached. There were two partial interviews in 2012-13

Physical survey

2.12 The physical survey form is designed to collect facts and observations about the dwelling and its surroundings, and observations and judgements about the condition of the property and what would need to be done to remedy defects.

2.13 The content of the physical survey has remained largely unaltered from the former EHCS. Surveyors continue to record details of the nature and type of each dwelling; the presence and condition of facilities and services; the condition of the internal and external building fabric; the presence and condition of shared facilities and services in blocks of flats or on estates and an assessment of the environment in which the dwelling is located. Assessments are made of health and safety risks associated with the dwelling and these were extended in 2008-09.

2.14 The content of the physical survey is reviewed annually and new questions are added where appropriate to reflect, for example, changing technology, e.g. the presence of solar panels or wind turbines.

2.15 In 2011, as part of the major EHS review (see paragraph 2.7), BRE and DCLG undertook an extensive review to identify and recommend areas and options for reducing the scope and complexity of the physical survey. Following this review:

- redundant questions were removed (details below)
- the separate HMO (house in multiple occupation) form was dropped with some questions added to section 7 of the main form
- the number of directly measured housing health and safety rating system (HHSRS) hazards was reduced from ten to six; the others became extreme risks

As a result of these changes, the length of the physical survey was reduced by three pages and the number of questions/decisions was reduced by 253.

Specific questions that were removed included:

- for vacant homes whether the dwelling is boarded up (page 2)
- whether the dwelling is a permanent residence, a second home or a holiday home (page 2)
- whether walls have dry lining (page 3)
- separable units - whether the dwelling contains some form of separate accommodation with its own amenities (page 3)

- the presence of specific kitchen amenities such as a washing machine and disrepair to secondary amenities actions (page 4)
- household questionnaire section of the physical survey; toilets (operation of flush, leaks to bowl), whether problems with flooded drains, whether any professional/non-professional treatment has been undertaken where problems exist with rats and mice (page 8)
- private entry stair – whether a flat has an internal or external staircase providing access to it but to no other flat (page 9)
- contribution of specific criteria e.g. poor design, to problems of general condition to common areas, presence of refuse chutes, defects, rats and mice in common areas (page 10)
- contribution of specific criteria e.g. poor design, to problems of general condition to shared facilities (page 12)
- section on boundary walls (page 17)
- whether blockage to underground drainage, situation of block (nature of the road on which the dwelling is located e.g. main road, side road) and ownership of the parking provision e.g. household, local authority (page 18)

The 2012-13 physical survey covered the following topics:

- amenities
- services, heating and energy
- construction
- measurement
- exterior and plot
- ageing elements
- Internal / external defects
- structural faults
- housing health and safety rating system
- pests
- drains
- common parts
- shared facilities
- flat construction and faults
- local area and environment

2.16 The full EHS 2012-13 physical survey form is published on the DCLG website: https://www.gov.uk/government/publications/english-housing-survey-physical-surveys

Chapter 3
Fieldwork

Fieldwork for the 2012-13 English Housing Survey (EHS) was managed on behalf of the Department for Communities and Local Government (DCLG) by NatCen Social Research. All interviews were carried out by trained NatCen Social Research interviewers; the surveys by professional surveyors employed by CADS Housing Surveys. This chapter provides further details of fieldwork procedures, including interviewer and surveyor training.

Overview

3.1 The 2012-13 survey was conducted by a consortium led by NatCen Social Research. The consortium included CADS Housing Surveys who employ a large field force of professional surveyors to undertake the visual inspection of properties, and Building Research Establishment (BRE) who are responsible for developing the physical survey questionnaire and surveyor training manuals and delivering the surveyor training sessions.

Fieldwork period

3.2 Fieldwork for the survey commences in April each year and is spread over the year, in eight batches with two consecutive months of fieldwork per quarter. Interviewers are given six weeks in which to complete their quotas of work. Surveyor fieldwork is the last three weeks of the interview fieldwork period.

3.3 Fieldwork dates for 2012-13 were as follows:

	Interviewer		Surveyor	
	Start	**Finish**	**Start**	**Finish**
Quarter 1				
Wave 1	01 April 2012	13 May 2012	21 April 2012	13 May 2012
Wave 2	01 May 2012	12 June 2012	26 May 2012	17 June 2012
Quarter 2				
Wave 1	01 July 2012	12 August 2012	21 July 2014	12 August 2012
Wave 2	01 August 2012	12 September 2012	25 August 2012	16 September 2012
Quarter 3				
Wave 1	22 September 2012	04 November 2012	13 October 2012	04 November 2012
Wave 2	20 October 2012	02 December 2012	10 November 2012	02 December 2012
Quarter 4				
Wave 1	04 January 2012	17 February 2013	26 January 2013	17 February 2013
Wave 2	01 February 2013	17 March 2013	23 February 2013	17 March 2013

Training and project briefings

Interviewers

3.4 Interviewers working on the EHS are drawn from the NatCen Social Research pool of interviewers. Prior to starting work at NatCen, all interviewers receive three days of intensive training, which includes CAPI training and workshops on doorstep technique. After this, interviewers are supervised for up to three days in the field. Interviewers are also encouraged to 'shadow' more experienced colleagues as a method to learn from others and to share experiences.

3.5 Before starting work on the EHS, all interviewers are required to attend a one-day briefing on the survey. In 2012-13, as all the interviewers were new to the EHS, they all attended a briefing. In total, 431 new interviewers were briefed at 26 briefings.

3.6 The briefings were run by NatCen Social Research and attended, where possible, by DCLG and CADS Housing Surveys. The briefings provided a comprehensive overview of the survey and covered:

- purpose of the study
- previous EHS findings
- study procedures including contacting respondents and identification and selection of dwellings and households, including HMOs (houses in multiple occupation)
- how to motivate respondents to take part

- survey documents
- booking appointments for the physical surveyor visit
- various exercises to test their understanding of the EHS
- (for new interviewers) going through a dummy interview

3.7 In advance of the briefing, interviewers were required to undertake a pre-briefing exercise. This involved reading the project instructions and completing a questionnaire covering the main survey procedures. The exercise was reviewed at the briefing.

Surveyors

3.8 EHS surveyors are employed by CADS Housing Surveys and trained by BRE on the technical content of the survey. Surveyors new to the survey receive a five-day residential briefing. The rigorous residential training involves both desk-based and practical sessions and is designed to encourage surveyors to adopt a standard approach to the assessment and reporting of the condition of dwellings. Surveyors working on the EHS come from a range of professional backgrounds. Approximately half are qualified Environmental Health Officers; the remaining are from a variety of professional groups including architects and building surveyors.

3.9 Each year, surveyors who have worked on the EHS previously receive a one-day refresher briefing, supplemented by distance learning modules. The modules and subsequent quizzes were completed by the surveyors at home prior to attending the briefing and the results fed back to them during a dedicated training session.

3.10 There is a limited amount of turnover of surveyors each year. In 2012-13, 155 surveyors (including Regional Managers) worked on the EHS, all of whom had worked on the survey previously. No new surveyors were recruited and a five-day residential briefing was therefore not required. The 151 surveyors and four Regional managers who had previously worked on the survey attended seven refresher briefings.

3.11 The 2012-13 refresher briefing was designed to cover the following aspects:

- identification of system built dwellings
- surveying HMOs
- ageing and repair of elements
- HHSRS Housing Health and Safety Rating System [HHSRS] and extreme risks
- refresh surveyors on those aspects of the recent Surveyor Variability SVS study which had the greatest variability: security, accessibility and local environment

Contact procedures

Letters

3.12 All addresses received a letter in advance of the interviewer's first visit explaining the purpose of the study and stating that an interviewer would be visiting shortly. The letter also included details of how the address had been selected and gave reassurances about confidentiality by stating:

Your personal details will be kept strictly confidential and no-one looking at the study findings will be able to identify you or your household in any way.

3.13 These letters were sent centrally by NatCen Social Research (i.e. not by the interviewers). The interviewers carry laminated copies of the letters with them to aid recall of the advance letter on the doorstep.

3.14 A copy of the advance letter is available at Annex 3.1.

Leaflets

3.15 Respondents were given a leaflet about the study on the doorstep. This provided additional information about the survey including examples of how previous EHS data have been used. It also addressed potential concerns about data protection and provided contact details for NatCen Social Research and web addresses for DCLG and NatCen Social Research.

3.16 Households selected for a physical survey were also given a leaflet describing the purpose of the surveyor's visit and what to expect from the physical inspection.

3.17 Leaflets are updated annually. Copies of the 2012-13 leaflets are available at Annex 3.2.

Interview survey data collection

3.18 Prior to seeking an interview with a respondent at a sampled address, the interviewer undertakes a series of contact procedures using the EHS 'doorstep form'. These include:

- collecting 'first impression' data from the sampled address to be used in non-response analysis
- dwelling identification and, where necessary, randomly selecting a dwelling. In a small number of cases the sampled address contains more than one dwelling, which is defined as a unit of accommodation (e.g. a flat) where all the rooms and amenities are for the exclusive use of the household(s) occupying them. So, for example, if a house has

been split into two self-contained flats then the interviewer randomly selects one flat to interview at
- identifying households and, where necessary, randomly selecting a household for interview
- collecting information from neighbours about non-contacts and vacant addresses

3.19 Properties that were vacant at the time of the interviewer's first call were then passed to CADS Housing Surveys to approach for a physical survey. These are sub-sampled on the same basis as occupied dwellings based on the last known tenure of the property.

Translations

3.20 NatCen employs some interviewers who can conduct the interview in a language other than English. However this is not always possible and interviewers tend to rely on household interpreters to complete interviews with non-English speakers. Household interpreters must be aged 13 or over and willing to translate on behalf of the interviewer.

3.21 In 2012-13, 11 interviews were carried out by a NatCen interviewer in a language other than English; 28 interviews were undertaken using a family or friend of the respondent as an interpreter.

Maximising response

3.22 In 2012-13, interviews were achieved for 13,652 households. This represents 59% of sampled addresses eligible for interview and is slightly below the target response rate of 60%.

3.23 Interviewers used a number of procedures to maximise response rates.

3.24 Interviewers were encouraged to make a minimum of nine calls at each address before classifying the address as a non-contact. These calls had to be at different times of the day and spread across the fieldwork period. At least two of these calls needed to be in the evening from Monday to Thursday and two had to be at the weekend.

3.25 Because of the adverse affect it would have on the surveyor fieldwork period, EHS addresses are not generally reissued, which is why interviewers are required to make so many calls at each address.

3.26 However, in 2012-13, below-target response in Quarter 1 meant that soft refusals and non-contacts were reissued: 957 cases in Wave 1 and 1,004 in Wave 2. Around three quarters of the cases that were reissued had refused or had a broken appointment at the first issue, and 20% had been non-contacts. The reissues were carried out by a different interviewer to the one who did the

first issue. Fieldwork for these reissues took place between 25 June and 22 July 2012. The impact that reissuing had on the response rate is discussed in more detail in the following chapter.

3.27 Due to below target response rates, an incentive was introduced in Quarter 3. From Quarter 3 onwards, all participating households were given a £10 gift card at the end of the interview. The impact of introducing an incentive on response rates is provided in the following chapter.

Surveyor appointments

3.28 Interviewers were also responsible for gaining consent from those households eligible for the physical survey. The approach to making appointments is kept under close review in order to maximise the consent rate. Information about the appointment times/preferences is transferred from NatCen Social Research to a secure CADS Housing Surveys website and CADS Helpline staff assist in changing and confirming arrangements between the surveyors and respondents for the physical inspection.

3.29 Interviewers were asked to make a firm, timed appointment wherever possible using information about the surveyor's availability. The interviewers were provided with a list of dates and 59-minute 'slots' when their surveyor had indicated they were available. This information was built in to the CAPI interview programme. Surveyors were also able to provide daily notes about each of their available days and overarching notes about their general availability and preferences for working. These notes were also displayed on the interviewers' laptop.

3.30 In 2012-13, interviewers were provided with more up-to-date information regarding the availability of the surveyor they were working with to undertake the follow-up physical survey. The surveyor's availability was updated each night during fieldwork. Interviewers obtained current availability, plus details of any existing appointments allocated to their surveyor, each time they connected with NatCen Social Research's servers, which they were instructed to do before starting work and when finishing work each day. Interviewers and surveyors were also provided with reciprocal contact details so that they could discuss work patterns and scheduling preferences if necessary.

3.31 As part of their training, interviewers were briefed on how to explain the physical survey to respondents and arrange the appointment for the surveyor to visit. Interviewer training included:

- the surveyor fieldwork periods
- transfer of information about appointments between CADS and NatCen
- how to make appointments and what to take into account when making them
- how to gain agreement from respondents for the physical survey

- a practice of the booking appointment section of the CAPI

Interview survey data collection

3.32 The content of the interview survey is reviewed annually (see Chapter 2 for more detail). NatCen and DCLG thoroughly check all new and revised questions in the CAPI programme before the beginning of fieldwork including:

- question and answer texts
- all routing alternatives
- textfills
- soft and hard checks

3.33 The data for the first wave are also checked to ensure that the new/revised questions are working properly.

3.34 The data collection process for the interview survey is as follows:

- interviewers conduct a computer-assisted personal interview (CAPI) with the household reference person (HRP) or their partner using a laptop
- interviewers upload the survey data to NatCen
- interviews are checked and edited where necessary by a team of editors; for example, if an interviewer makes a note in the CAPI that they are unsure how many bedrooms there are, the editor will check the note against the criteria for bedrooms and correct the answer if it is wrong

3.35 As part of the interview, private sector tenants are asked for permission to contact their landlord and to provide their landlord contact details. Those cases where this permission is given, and contacts can be successfully traced, form the sample for the EHS Private Landlords Survey (PLS). This survey with landlords and agents collects information on the size and composition of different groups of landlords, their property portfolio, why they are involved in renting, how they approach the maintenance and management of their properties, their future plans and their views on a range of issues within the private sector market.

3.36 The PLS was last conducted in 2010 based on landlord contact details collected in 2007-08 (by the EHCS) and in 2008-09 (by the EHS). Results were published on the DCLG website in 2011[1]. Data are available for download from the UK Data Archive. A PLS was not conducted in 2012-13,

[1] www.gov.uk/government/publications/private-landlords-survey-2010

although information on landlords was still collected to enable a PLS to be conducted at some point in the future.

Physical survey data collection

3.37 The data collection process for the physical survey is as follows:

- surveyors conduct the survey using a digital pen, paper form and digital camera
- the paper form features a series of small black dots (Anoto pattern) that can be read by a digital pen. Every page has a unique combination of dots with different positions. The pattern indicates the exact position of the digital pen as it writes across each page. During a survey the digital pen's inbuilt camera captures and stores digital snapshots of the pen marks across the Anoto pattern
- surveyors upload the survey data to a dedicated website where it is displayed as a facsimile of each page, for the surveyor to check and correct electronically. An extensive series of validation checks on range, plausibility and consistency have been developed which enable the surveyor to validate their own survey before submitting it to their regional manager
- photographs are added to the website
- corrected data are submitted to their regional manager for final checking and, if necessary, returned to the surveyor for correction or clarification via the website
- the checked data are forwarded to BRE by regional managers for consolidation with the EHS results

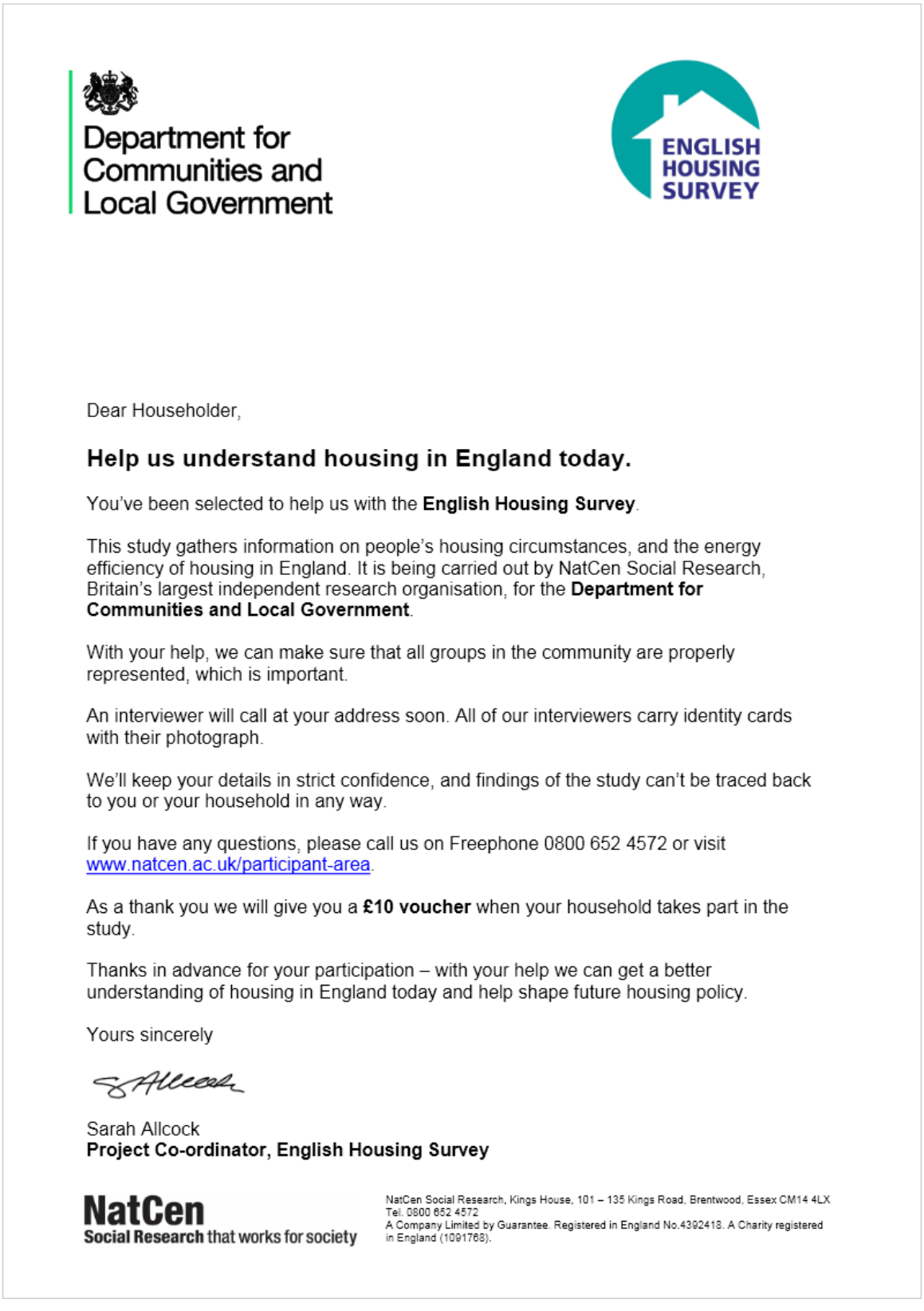
3.38 The subjective nature of some assessments required for the physical survey means that a degree of variability is inevitable between surveyors in some of their judgements. To minimise the impact that any one surveyor can have on the results of any one area or type of property an annual upper target of 65 is set on the number of surveys any one surveyor can complete. An additional restriction is set relating to work within any one region, such that no one surveyor should complete more than 45 full surveys in any region (a limit of 36 exists for the North East as fewer physical surveys are conducted in this area compared with other areas). These rules contribute to improving the statistical reliability of the survey and providing more robust measures of housing conditions below the national level. In 2012-13, each surveyor was restricted to carrying out a certain number of surveys in a region (i.e. 45 or 36). Prior to this, the restriction had been expressed as a percentage of the total surveys completed within that region (e.g. surveyor was only allowed to carry out 3% of the surveys in a region). This meant that the actual number of surveys they were allowed to do varied each year, and depended on the response in their region(s). The change of approach in 2012-13 made it easier to manage

regional limits, as maximum numbers were fixed in advance at the start of the year.

3.39 Although not used in 2012-13, calibration workbooks have been used in previous years to detect any variability that arises from surveyors making different judgements given the same information. The next scheduled calibration exercise is due to be undertaken in 2014-15. More detail on how the calibration workbooks have informed previous waves of the survey can be found in the 2011-12 technical advice note on data quality, published on the DCLG website: https://www.gov.uk/government/publications/english-housing-survey-technical-advice.

3.40 To further analyse the effects of systematic surveyor variability on the precision of estimates from the physical survey, a Surveyor Variability Study (SVS) is routinely undertaken. Last conducted in 2009-10, the study involved a call-back exercise in which 300 properties were re-surveyed by a second surveyor and the results were compared. The 2009-10 SVS found that, overall; there was a high level of agreement between surveyors' assessments of properties. The next scheduled SVS will take place during the 2014-15 survey year. More information can be found in the 2009-10 SVS summary report, published on the DCLG website: https://www.gov.uk/government/publications/english-housing-survey-technical-advice

Annex 3.1: Advance Letter



Department for Communities and Local Government

ENGLISH HOUSING SURVEY

Dear Householder,

Help us understand housing in England today.

You've been selected to help us with the **English Housing Survey**.

This study gathers information on people's housing circumstances, and the energy efficiency of housing in England. It is being carried out by NatCen Social Research, Britain's largest independent research organisation, for the **Department for Communities and Local Government**.

With your help, we can make sure that all groups in the community are properly represented, which is important.

An interviewer will call at your address soon. All of our interviewers carry identity cards with their photograph.

We'll keep your details in strict confidence, and findings of the study can't be traced back to you or your household in any way.

If you have any questions, please call us on Freephone 0800 652 4572 or visit www.natcen.ac.uk/participant-area.

As a thank you we will give you a **£10 voucher** when your household takes part in the study.

Thanks in advance for your participation – with your help we can get a better understanding of housing in England today and help shape future housing policy.

Yours sincerely

Sarah Allcock
Project Co-ordinator, English Housing Survey

NatCen
Social Research that works for society

NatCen Social Research, Kings House, 101 – 135 Kings Road, Brentwood, Essex CM14 4LX
Tel. 0800 652 4572
A Company Limited by Guarantee. Registered in England No.4392418. A Charity registered in England (1091768).

How did you choose my address?

We chose your address at random from the Postcode Address File. This file is held by the Post Office and is available to the public.

What will happen to any information I give?

We will treat information you give in strict confidence under the Data Protection Act 1998. Your information will be used by the Department for Communities and Local Government and the Department of Energy and Climate Change for the production of statistics only.

For details of the English Housing Survey's Data Security Strategy, please see: www.gov.uk/government/publications/english-housing-survey-data-security-strategy-and-arrangements.

Who is carrying out the study?

The Department for Communities and Local Government has asked NatCen Social Research to carry out the study.

What is the interview about?

The interview covers a range of housing topics including your housing circumstances, satisfaction with your accommodation and neighbourhood, and energy efficiency in your home.

How will my contribution help?

The anonymous statistics will be used by government to help develop housing and energy-related policies.

The statistics are also used outside of government. For example, housing organisations, such as the National Fair Housing Alliance, and charities, such as Age UK and Shelter, freely use the anonymous data.

Where can I spend my £10 voucher?

Your voucher is a £10 gift card which you can spend at a number of high street shops, such as Argos, Debenhams and Boots.

Annex 3.2: Leaflets

Interviewer (main survey) leaflet

The English Housing Survey

This leaflet answers some of the questions you may have about taking part in this study.

What is the English Housing Survey?

The English Housing Survey (EHS) is conducted by NatCen Social Research on behalf of the Department for Communities and Local Government (DCLG), the department responsible for developing government housing policy in England.

The study is the main source of information on people's housing circumstances and the condition of housing in England. It collects up-to-date information from all types of households – whether they are owner-occupiers or rent from a local authority, housing association, or private landlord. The EHS is conducted throughout the year across England.

All sectors of society are represented, ensuring that the study results reflect the population of the country.

Who are NatCen Social Research?

NatCen Social Research are an independent, non-profit institute with a core team of over 150 research specialists and 1,200 interviewers. Last year we developed more than 75 social research reports for government, educational bodies, charities and responsible businesses. At NatCen Social Research we believe our work has the power to make people's lives better.

Why does this study matter?

The study results are used by the government to assess how housing circumstances vary across the country and between different types of household.

This information helps to:

- measure whether housing conditions are getting better or worse, and how satisfied people are with their home and neighbourhood;
- understand whether housing is affordable, both for renters and private owners;
- show whether the steps taken to improve energy efficiency and cut carbon emissions in both public and private housing are working; and
- target housing policies and resources. The study's results are used to ensure that funding is directed to the people and regions where it is most needed.

More information about the study is available from the DCLG web site:
www.gov.uk/government/organisations/department-for-communities-and-local-government/about/statistics

The study's results

The study's results are also used by housing associations, non-governmental organisations, surveyors, universities and others. Here are two examples of results:

Tenure split within age group of householder, England, 2009-10

Source: 2009-10 English Housing Survey, full household sample

Percentage of homes with damp problems, by tenure, 2010

Source: English Housing Survey 2006, dwelling sample

Is the study confidential?

Yes, the information you give us will be treated as strictly confidential as directed by the Code of Practice for Official Statistics. It will be used by the Department for Communities and Local Government (DCLG), and their counterparts in the Department of Energy and Climate Change (DECC), to produce anonymous statistics that will not identify you or anyone in your household. These anonymous statistics are analysed by government and other approved organisations, such as universities, non-governmental organisations, and surveyors. For further details see DCLG's EHS Data Security Strategy on their website.

Why did we choose you?

As it is not possible to ask everyone to take part in the study, a selection of addresses is selected to represent the entire country. Your address is one of these and was selected at random from a list of postal addresses held by Royal Mail.

You are important for the study because the random sample will give a true cross-section of the community. We are interested in people from all age groups, all parts of the country, and all types of homes.

We cannot substitute another address for yours as this would bias the sample's results, so your contribution is very important to the study. By taking part you help us provide an accurate picture of how changes in the economy and government policy affect you and your community.

Contact us

If you have any queries about taking part in this study, please call our freephone Survey Enquiry Line on 0800 652 4572.

Alternatively, you can write to:

NatCen Social Research
Operations Department
101-135 Kings House
Kings Road
Brentwood
Essex
CM14 4LX

Thank you for your help.

To find out more about NatCen Social Research, visit our website: www.natcen.ac.uk/about-us

Department for Communities and Local Government

NatCen Social Research that works for society

Interviewer leaflet_v4

ENGLISH HOUSING SURVEY

Why your help is important

www.natcen.ac.uk

Physical Survey leaflet

The survey team comprises:

Department for Communities and Local Government

The Department for Communities and Local Government (DCLG) is the government department that sponsors the EHS to collect information on changing trends in housing, the condition of the housing stock and the characteristics of households living in different types of housing.
www.gov.uk/government/organisations/department-for-communities-and-local-government/about/statistics

NatCen
Social Research that works for society

NatCen Social Research are an independent, non-profit institute, working for government, educational bodies, charities and responsible businesses. NatCen Social Research are conducting the household interview part of the study.
www.natcen.ac.uk

mmbl | CADS

MMBL-CADS will be conducting the visual inspection of the property using professional surveyors qualified to assess housing conditions and energy efficiency.
www.cadesignservices.co.uk

Your appointment with the surveyor is:

Date: _____

Time: _____

Name of surveyor: _____

EHS Helpline: 0845 389 0486

Physical survey leaflet_v3

ENGLISH HOUSING SURVEY

Explaining the surveyor's visit

Thank you for taking part in the interview which was the first part of the English Housing Survey (EHS) study. We hope you will now agree to take part in the second phase which consists of a physical inspection of your property.

Just over half of all households where an interview has taken place are randomly selected for a follow-up physical inspection by a surveyor.

We would like to arrange a convenient time when a qualified surveyor can visit your home. The interviewer has details of when surveyors are working in your area.

Who will conduct the physical inspection?

The EHS is conducted on behalf of the Department for Communities and Local Government (DCLG). DCLG have appointed MMBL-CADS to undertake the physical inspection. MMBL-CADS employ professional surveyors qualified to conduct the EHS assessments.

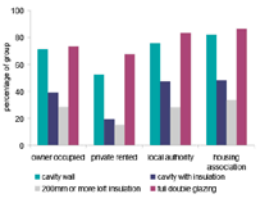
What is the purpose of the physical inspection?

During the interview you kindly told us about your housing circumstances and aspirations, and your views on your home and neighbourhood.

To supplement this information we also need a professional assessment of your home so that we can determine what types of household are living in the least energy efficient homes and how housing conditions vary between household groups.

The chart below gives just one example of results available from the information collected by the EHS.

Percentage of dwellings with efficient insulation measures by tenure, 2010



Source: English Housing Survey, dwelling sample

What will the surveyor do?

Our surveyor will call at an agreed time that is convenient to you. On arrival the surveyor will introduce themselves and show you their identity card.

Their assessment will take about an hour and although most of this will be spent surveying the outside of the home, they will ask to see all the rooms inside. The inspection is a visual one and will not involve any disruption to your home or belongings.

Do I have to take part in the physical inspection?

As with the interview, we rely upon voluntary co-operation, which is essential if our research is to be successful. Your home has been chosen at random to provide a balanced picture of all parts of the country and types of property and household. By taking part you help us to provide an accurate picture of housing in England.

Should I let my landlord or freeholder know I am taking part?

There is no reason to inform your landlord or freeholder of your participation unless you want to. As the interviewer will have explained, all your responses at interview and the information collected at the physical inspection will remain confidential and will not be passed onto your landlord.

Will I get any feedback after the physical inspection?

While the EHS is designed to provide government with a reliable assessment of the energy efficiency and condition of the housing stock it is not as detailed as a survey that you would pay to have conducted yourself. We are not therefore able to provide any feedback on your home unless the surveyor identifies any issues which they consider to be an imminent risk to you or your family. In this situation they will alert you to the problem and advise you to take immediate action.

Is the physical inspection confidential?

The information collected at both the interview and physical inspection stages of the study is handled in the strictest confidence by DCLG, NatCen Social Research, and their appointed contractors as directed by the Code of Practice for Official Statistics. It will be used to produce statistics that will not identify you or anyone in your household. These anonymous statistics are analysed by government and other approved organisations, such as universities, Non-Governmental Organisations, and surveyors.

Thank you for agreeing to take part in this important national study.

Users of the study leaflet

Chapter 4
Response rates

The target response rate for the 2012-13 English Housing Survey (EHS) was 60%. This chapter provides details of the final response rates and information on action taken to maximise response.

Overview

4.1 The target response rate for the EHS is set by the Department for Communities and Local Government (DCLG). It is monitored closely by NatCen through analysis of electronic data reports and direct contact between interviewers and their team leader. NatCen sets and monitors targets for coverage within each wave and monitors response at an area and interviewer level. When response rates fall below the target, remedial action is taken. In 2012-13, this remedial action included reissuing addresses in Quarter 1 and the introduction of a conditional incentive in Quarters 3 and 4.

Interview survey

4.2 In 2012-13, interviews were achieved at 13,652 households. This represents a response rate of 59%. More details on the response rate to the EHS interview survey in 2012-13 are provided below, Table 4.1.

4.3 Of these 13,652 interviews, 80% were conducted with the household reference person (HRP), 19% with the HRP's partner and 1% with a proxy.

Table 4.1: Interview survey response rate, 2012-13

all issued households

	Number (N)	Issued cases (%)	In-scope cases (%)
Total issued addresses	**25,286**		
Not yet built/under construction	25	0.1	
Demolished/derelict	66	0.3	
Vacant/empty housing unit	1,116	4.4	
Non-residential address	295	1.2	
Address occupied - no resident household	338	1.3	
Communal establishment/institution	57	0.2	
Other ineligible	64	0.3	
Total ineligible addresses	**1,961**	**7.8**	
Total in-scope addresses	**23,325**	**92.2**	
Not issued	1	0.0	0.0
Issued, but not attempted	26	0.1	0.1
Inaccessible	25	0.1	0.1
Unable to locate address	40	0.2	0.2
Unknown whether residential: Info refused	1	0.0	0.0
Unknown whether residential: no contact	39	0.2	0.2
Residential but unknown eligibility: info refused	4	0.0	0.0
Residential but unknown eligibility: no contact	61	0.2	0.3
Other unknown eligibility (no contact)	31	0.1	0.1
Contact but not confirm if address is residential	1	0.0	0.0
Info refused whether resident(s) are eligible	3	0.0	0.0
Eligibility not confirmed: language barrier	7	0.0	0.0
Other unknown eligibility (contact made)	25	0.1	0.1
Total unknown eligibility	**264**	**1.0**	**1.1**
Refusal by phoning office	944	3.7	4.0
Information refused on no. of dwellings	116	0.5	0.5
Can't identify target respondent(s): info refused	230	0.9	1.0
Information refused about number of households	91	0.4	0.4
Refusal before interview: by selected respondent	4,631	18.3	19.9
Proxy refusal	87	0.3	0.4
Refusal during interview (unproductive partial)	29	0.1	0.1
Broken appointment, no re-contact	750	3.0	3.2
Total refusals	**6,878**	**27.2**	**29.5**
No contact with anyone at address	1,444	5.7	6.2
MULTI DWELLINGS - No contact made with selected dwelling	8	0.0	0.0
No contact with responsible adult	167	0.7	0.7
Contact made at DU, but not from selected HH	88	0.3	0.4
Total non contact	**1,707**	**6.8**	**7.3**
Ill at home during survey period: Head Office	13	0.1	0.1
Ill at home during survey period: Interviewer	132	0.5	0.6
Away or in hospital all survey period: Head Office	27	0.1	0.1
Away or in hospital all survey period: Interviewer	232	0.9	1.0
Physically/mentally unable/incompetent: Head Office	31	0.1	0.1
Physically/mentally unable/incompetent: Interviewer	215	0.9	0.9
Language difficulties: Head Office	27	0.1	0.1
Language difficulties: Interviewer	94	0.4	0.4
Lost productive	2	0.0	0.0
Interview achieved but respondent requested data deleted	7	0.0	0.0
Other unproductive	44	0.2	0.2
Total other unproductive	**824**	**3.3**	**3.5**
Full interview	13,650	54.0	58.5
Partial interview	2	0.0	0.0
Total interviews	**13,652**	**54.0**	**58.5**

4.4 In 2012-13, the response rate dropped below the target of 60%. In an effort to increase the response rate a number of remedial actions were taken. These are described below.

Reissues

4.5 In Quarter 1 (Waves 1 and 2), 1,987 cases were reissued (981 cases in Wave 1 and 1,006 in Wave 2). Around three quarters of the cases that were reissued had refused or had a broken appointment at the first issue, and a fifth had been non-contacts. The reissues were carried out by a different interviewer to the one who did the first issue. Fieldwork for these reissues took place between 25 June and 22 July 2012.

4.6 In Wave 1, 1,384 interviews were carried out at first issue (a response rate of 54%). Another 173 interviews were achieved after reissue (a conversion rate of 19%). This increased the overall Wave 1 response rate to 62%[1].

4.7 In Wave 2, 1,405 interviews were carried out at first issue (a response rate of 53%). A further 136 interviews were achieved after reissue (a conversion rate of 15%). This increased the Wave 2 response rate to 59%[2].

4.8 Reissuing cases was effective in increasing response. However, it had two key drawbacks. First, households which were interviewed at the reissue stage and agreed to the physical survey had to have appointments after the fieldwork period allocated to surveyors for that wave. This required additional coordination and in some cases it was not possible to arrange a surveyor appointment. Second, reissues are very costly. For these reasons it was decided to not continue reissuing cases after Quarter 1 and, from Quarter 3, to adopt a conditional incentive instead.

Incentives

4.9 A conditional incentive was introduced in Quarter 3, from which point all participating households were given a £10 gift card at the end of the interview. Response increased from 53% in Quarter 2 to 59% in Quarter 3 and 62% in Quarter 4, Table 4.2.

[1] Some of these interviews were omitted from the final response figures for various reasons e.g. because the respondent asked for the data to be deleted or they were found to be ineligible.
[2] As above.

Table 4.2: Number of addresses interviewed per quarter, 2012-13

all addresses in scope

	Interviewed	In scope	Response
Quarter 1	3,087	5,145	60.0%
Quarter 2	3,368	6,297	53.5%
Quarter 3	3,368	5,682	59.3%
Quarter 4	3,829	6,201	61.7%
Whole fieldwork period	**13,652**	**23,325**	**58.5%**

Physical survey

4.10 Not everyone who takes part in the interview survey is eligible to take part in the physical survey. Cases eligible[3] for the physical survey are identified by the CAPI (computer-aided personal interviewing) programme as part of the interview survey. Interviewers are then responsible for securing the consent of the householder to a physical survey. The interviewer explains the purpose of the survey and briefly what it will involve. If the respondent is willing, the interviewer arranges a fixed appointment for the physical survey. The interviewer is provided with the times the surveyor is available on their laptop to help make the appointment.

4.11 Of the 9,590 interviewed households eligible for the physical survey, 76% agreed to have a physical survey, which is below the target of 80% (see end of chapter).

4.12 In 2012-13, 6,304 physical surveys were achieved. Of these, 6,058 were surveys in occupied properties. This represents 83% of households which agreed to a physical survey at the interview. This was below the target of 85% conversion rate (see end of chapter).

4.13 The remaining 246 surveys were conducted at vacant addresses. This represents 32% of the vacant addresses eligible for a physical survey. This is above the target of 30% conversion rate for such properties. More details on the response rate to the physical survey for the EHS in 2012-13 are provided below, Table 4.3.

[3] See Chapter 1 on sub-sampling for more information on how addresses are deemed eligible for the physical survey.

Table 4.3: Physical survey response rate, 2012-13

all addresses eligible for physical survey

	Number (N)	Cases eligible for PS (%)	Cases agreed to PS at IS (%)
Occupied addresses			
Total occupied addresses eligible for physical survey	**9,590**		
Eligible but refused appointment at interview	2,299	24.0	
Eligible and agreed appointment at interview	7,291	76.0	
Total unproductive	**1,233**	**12.9**	**16.9**
Incomplete survey	8	0.1	0.1
Refusal on doorstep	209	2.2	2.9
Refusal to HQ	752	7.8	10.3
Household missed appointment	63	0.7	0.9
Surveyor missed appointment	2	0.0	0.0
Spec call no contact	172	1.8	2.4
Other reasons for non survey	27	0.3	0.4
Full survey (paired cases)	6,058	63.2	83.1
Vacant/derelict addresses			
Total vacant/derelict addresses eligible for physical survey	**824**		
Eligible but refused appointment at interview	67	8.1	
Total unproductive	**511**	**62.0**	**67.5**
Incomplete survey	1	0.1	0.1
Refusal on doorstep	114	13.8	15.1
Refusal to HQ	41	5.0	5.4
Household missed appointment	11	1.3	1.5
Spec call no contact	321	39.0	42.4
Spec call - appointment made	2	0.2	0.3
Other reasons for non survey	21	2.5	2.8
Survey achieved (vacant)	237		
Survey achieved (derelict)	9		
Total vacant/derelict physical surveys achieved	**246**	**29.9**	**32.5**
Total physical surveys achieved	**6,304**	**60.5**	**78.3**

Notes:

1) for the occupied addresses the cases eligible for a physical survey is the total occupied addresses eligible for the physical survey; and the cases agreed to a physical survey at interview survey is the total occupied addresses who agreed to have a physical survey at the interview.

2) for the vacant addresses the cases eligible for a physical survey is the total vacant addresses eligible for the physical survey; and the final column is the percentage out of all the eligible occupied addresses excluding those who refused an appointment at the interview stage (not all the vacant addresses were contacted at the interview stage so did not have the chance to refuse).

3) the cases eligible for a physical survey is all the occupied and vacant addresses eligible for the physical survey; and the cases agreed to a physical survey at the interview survey is all the occupied and vacant addresses who did not refuse to have a physical survey at the interview stage.

4.14 Interviewers and surveyors were encouraged to speak to each other before interviewer fieldwork commenced to discuss any issues there may be on availability and booking appointments for the physical survey. Interviewers and surveyors were each provided with reciprocal contact details to facilitate this contact. (Prior to 2012-13, only interviewers had contact details for surveyors and could initiate this contact.)

4.15 The overall response rate for the physical survey decreased from 68% in 2011-12 to 61% in 2012-13. There are a few possible reasons for this. The proportion of households consenting to a physical survey at the end of the interview has decreased. In the first few waves of fieldwork there was a higher level of “soft” appointments (whereby the respondent agreed to have a physical survey but no fixed appointment was made), which are less likely to result in a productive survey than fixed appointments. In Quarter 1 some cases were reissued to interview (to increase response to the interview) which meant that there was not enough time to carry out physical surveys. Furthermore, some physical surveys were not undertaken at the end of the year as the required number had already been achieved.

Chapter 5
Data processing

This chapter outlines English Housing Survey (EHS) data processing procedures and gives details of the main derived variables and data outputs.

Overview

5.1 The EHS has a number of quality assurance measures in place which take place throughout the annual survey process, beginning at the point of data collection, both through the CAPI system and through surveyors validating their forms using the online system developed by BRE (details below). As the data are collated, processed and modelled, additional validation procedures are undertaken.

Editing

Interview data

5.2 The CAPI has numerous checks built into the program to identify obvious discrepancies so that they can be resolved by the interviewer during the interview. The discrepancies are resolved by either correcting a data entry error or by clarifying a response directly with the respondent. The CAPI checks include:

- Range checks – e.g. if an unusually high/low weekly rent is entered
- Conflicting answers to different questions – e.g. if the number of years living in the current accommodation is greater than the respondent's age.

5.3 There are two types of checks:

- Hard checks – where the interviewer cannot continue with the interview until they have changed the data entered in some way to remove the inconsistency. Hard checks are used when the inconsistency is impossible as with the example of the number of years living in current accommodation being greater than the respondent's age.
- Soft checks (signals) – where the interviewer is told about the error but they can ignore it and move on to the next question. Soft checks are used when an answer is unlikely but not impossible, e.g. if a respondent says

they have more than 5 bathrooms. These checks are used to get the interviewer to confirm that the answer is correct and is not a data entry error, checking the answer with the respondent if appropriate.

Physical survey data

5.4 For the physical survey, a system of data validation was introduced as part of the move to using digital pens. The process is subject to continuous development and operates as a three-stage process.

5.5 Firstly, a large number of checks are built into the EHS surveyors' website as surveys are uploaded. These include:

- range checks – where the entered answer fell outside a valid range of responses
- logic checks – where a combination of responses to certain questions were not logically consistent (e.g. to check that the sum of 'tenths of area' across rows added up to ten)
- consistency checks – to determine whether linked responses in different parts of the form were consistent with each other (e.g. that detailed room data was only entered where a room had been coded as existing), and
- plausibility checks – to determine whether a response was reasonable given that there was not a well-defined range of possible answers (e.g. ceiling height of a room entered as 24 metres instead of 2.4 metres)

5.6 Surveyors also visually check all pages to ensure that the digital pen entries mirror those on the paper form i.e. that handwritten numbers have not been misinterpreted by the software.

5.7 Secondly, the CADS Housing Surveys Regional Managers check the data and where necessary discuss with surveyors to agree on a final set of responses.

5.8 Once all EHS physical surveys have been submitted by the surveyors for the survey year, BRE undertakes a number of consistency and plausibility checks on the raw physical survey data. The purpose of these checks is to firstly detect and eliminate certain logical inconsistencies that would cause problems for modelling and secondly to identify highly implausible answers, which if deemed necessary after investigation, are corrected. In some cases the raw EHS physical survey data is altered following these consistency and plausibility checks as outlined below.

- **Levels checks** – data may be inconsistent with regard to the number of storeys in the building, and the floor occupied by the dwelling. The BRE checks test for the following possible errors:

- A room on a level that does not exist (e.g. 3rd floor of a three storey module)
- A room on a level that is not part of the flat (e.g. room on the 3rd floor but flat on the 2nd floor)
- A measured level that is not part of the module (e.g. dimensions for 3rd floor when the dwelling only has three storeys)
- A flat on a level that does not exist (e.g. flat on the 3rd floor when the module only has three storeys).
- Cross checks for presence of a habitable attic/basement and number of floors.

- **Plausible dimensions** – checks are carried out on the dimensions, to identify any floor area that seems too large or too small. Where a reliable measurement is missing, BRE will attempt to work out the data from any measurements thought to be correct, or failing this by estimating the dimensions as best as possible from the photographs.
- **Non permissible values** – on rare occasions a dimension may happen to be equal to a value that is reserved for special purposes. The numbers 77, 88 and 99 are reserved to indicate the section not applicable, question not applicable, or unknown. When these figures occur as real measurements, they are reduced by one.
- **Incorrect number of flats** – the dimensions of the surveyed flat are checked against the total floor area of the survey module to identify if the number of flats per module seems realistic.
- **Incorrect roof type** – certain roof types (chalet and mansard) can only occur where the dwelling has an attic. On occasions surveyors may mistake steep pitched roofs for chalet roofs. In this situation, the data for pitched and chalet roofs is swapped over.
- **Implausible wall areas** – where a dwelling seems to have a wall area that is too high or too low the data is checked. The surveyor's judgement is deemed correct unless there is clear evidence (e.g. from photographic evidence) to amend the data.

Comparison edits

5.9 A further important quality check involves comparing interview survey data with the corresponding physical survey data for each case. Possible discrepancies between the two parts of the survey are flagged, investigated and recoded as applicable. This information is used to check:

- that the correct sampled dwelling was visited at both the interview survey and the physical survey, and

- any inconsistencies in key variables (e.g. tenure, property type) between the two different parts of the survey. Where possible other information within the survey (e.g. other variables, interviewer's and surveyor's comments, photo of the property) is checked to help decide what information is correct.

Houses in Multiple Occupation (HMO) Edits

5.10 The identification of HMOs is critical in order to help ensure the accuracy of the weighting for the sample dwelling. A procedure exists to enable the monitoring, reconciliation and validation of cases which have been flagged as HMOs by NatCen Social Research interviewers and/or CADS Housing Surveys surveyors.

5.11 Cases are flagged as HMOs depending upon responses to certain key questions in the household questionnaire. Interviewers are trained in applying the EHS household definition and assessing the type of occupancy in complex situations, particularly in making the distinction between a group of sharers forming one household and separate households sharing facilities. Where necessary, reference is made to a check list of supplementary questions on the HMO Rules Card issued to interviewers (Annex 5.1) to determine whether an address should be classified as an HMO.

5.12 Where the responses to the interview questions lead to the dwelling being flagged as an HMO, and the dwelling is eligible for a physical survey, the CADS Housing Surveys Regional Manager is notified. The Regional Manager will contact the interviewer to discuss the layout and occupation of the premises. The purpose of this contact is twofold:

- To confirm, as far as possible, that the address is an HMO for EHS purposes
- To determine whether the case is one that should be visited by the regional manager personally, as a complex HMO, or whether it should be allocated to a surveyor.

5.13 There will be occasions when a physical surveyor considers that a referred address appears to be an HMO despite not being flagged as such by the NatCen interviewer. In such cases, the surveyor will treat the case as an HMO, and a reconciliation process is applied to the interview and physical data during the final data validation stage.

5.14 CADS Housing Surveys Regional Managers compile and maintain a database of all cases they know to be HMOs. These cases are reviewed by NatCen and BRE for data validation as part of the comparison edits process.

5.15 A record of all address changes are recorded by interviewers and/or Regional Managers for HMO cases as part of a comprehensive system for recording

address changes for all issued cases. This feeds into the address file supplied to DCLG at the end of fieldwork.

Coding

5.16 After the interview, the data is coded and edited by trained coders and editors at NatCen Social Research. An edit program is utilised, which includes coding of open answers and back-coding of responses as appropriate.

5.17 For example, interview respondents are asked how they pay for their electricity at HmpyElec2, and the respondent is shown eight possible answers (e.g. direct debit) on a card. If their payment method is not on the list the interviewer will code 'other' and is asked to enter the details of the payment method at a follow up question (Hmelothr). After the interview, the coder will look at the details given at Hmelothr and check it against the eight answer codes to see whether it could be classified as one of these payment methods and if it can they will change the answer as appropriate.

5.18 Job details are also coded to the Standard Occupation Classification (SOC) and Standard Industry Coding (SIC).

5.19 Error reports are referred back to the original questionnaire documents by experienced editors and individual corrections are specified until reruns of the edit program confirm that the data are clean. Coders record queries in a standardised way and these are examined by the supervision team on completion of each batch of work.

5.20 After the coding and editing stage further internal consistency checks on the data are carried out by a data manager and the data is corrected where appropriate.

Derived variables

5.21 A full list of derived and geo-demographic variables can be found in Annex 5.2. Further details on the derivation of these variables are available in the EHS Data Dictionary, publicly available on the UK Data Archive (http://ukdataservice.ac.uk/).

5.22 Some geo-demographic variables (local authority and postcode) are not included in the publicly available dataset (details below). Approved researchers can make an application to the Secure Data Service to access these variables for legitimate research purposes.

5.23 The following geo-demographic variables were added to the data:

- gorEHCS – Government office region (ordered according to the previous English House Condition Survey)
- GorEHS – Government office region (EHS order)
- region3x – overall region of England
- rumorph – rurality (morphology COA1)
- rucontxt – rurality (context COA)
- rucombin – rurality (combined COA)
- Imd1010 – IMD 2011 decile ranking of areas (lower layer SOA[2])

Modelling

5.24 The derivation of some of the derived variables involves complex modelling. A detailed description of how the more complex derived variables are defined and modelled is covered in Annexes to this chapter:

- Annex 5.3: Accessibility indicators
- Annex 5.4: Household indicators
- Annex 5.5: Housing and neighbourhood conditions
- Annex 5.6: Energy efficiency

Space

5.25 **Floor area** – The EHS also models total useable floor area at the dwelling (see variable 'floorx' in the Data Dictionary for further modelling details). It is important to recognise that there is no standard definition on useable floor area, with some different methodologies to the EHS in existence. A more extensive review of technical documentation for this modelling will be undertaken for next year's report.

5.26 **Bedroom size** – For those homes where a separate bedroom did not exist, bedroom dimensions were taken from the living room where its function is recorded as a living room, dining room or bedsit. For the 13 cases with no separate bedroom and living room function was coded as not applicable, bedroom size is coded as not applicable. A further 21 cases are coded as unknown as, although a separate bedroom exists, it was not inspected and

[1] Census output areas, see http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/census/output-area--oas-/index.html
[2] Super output areas, see http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/census/output-area--oas-/index.html

hence dimensions not recorded. Extreme values were observed but not amended as it was not possible to determine if these values legitimate without extensive analysis. Banded area was not based on percentiles as cut-off values were too close and instead more sensible cut-offs were used.

Imputation

5.27 As part of the modelling processes, it is sometimes necessary for any missing data that may exist to be substituted with imputed values. The imputation of missing data is more prevalent with the interview survey data than the physical survey data. This is because the interview survey data is based on information provided by the householder and the householder can choose to refuse questions (no answer) or they may not know the answer to particular questions (do not know) leading to missing values. The physical survey data is based upon a physical inspection of the property and there are limited sections of the physical survey form where the trained surveyor can select unknown (missing) as an option, the most notable is the loft inspection, where surveyors cannot always obtain access.

5.28 Imputation of data also takes place in the modelling of derived variables where a value provided in the raw data falls outside of consistency/plausibility checks. Such values are interrogated and only changed when it is almost certain that the data are incorrect. See Annexes 5.3, 5.4, 5.5, and 5.6 for further details.

5.29 Examples of imputation that occurred in the modelling of EHS 2012 derived variables are as follows (figures are based upon weighted data):

- In the modelling of the EHS 2012 complex interview survey derived variables 43% of the full sample had some form of income imputation (the highest imputation rate amongst all of the derived variables due to the sensitive nature of the questions), 14% of renters had imputed weekly rents and 19% of households with a mortgage had their weekly mortgage payments imputed. These imputations were due to a combination of missing raw data and values which are implausible.
- In the modelling of the EHS 2012 dimensions of the property e.g. derivation of floor area, external wall area etc. a total of 83 cases in the paired single year had some form of alteration to the raw physical survey data following consistency and plausibility checks on the raw physical survey data.
- In the derivation of loft insulation (which also feeds into SAP09 energy modelling and the modelling of Decent Homes), for the EHS 2012 single year paired sample, 9% of dwellings with a loft were imputed a value for loft insulation due to either the property having a flat roof or no access to

the loft space was possible during the physical inspection of the property. This is the largest imputation rate in the derivation of the energy efficiency rating.

5.30 Treatment of any missing cases from the raw physical and interview data analysed for EHS reports are detailed in the annual reports where appropriate.

Data outputs

5.31 The following SPSS datasets are produced annually, Table 5.1.

Table 5.1 List of annual datasets

Physical datasets	Interview datasets	Detailed datasets	Derived datasets (paired sample)	Derived datasets (full household sample)
Amenity.sav	Attitudes.sav	Actual costs.sav	general.sav	generalfs.sav
Around.sav	Contact.sav	Dimensions.sav	physical.sav	interviewfs.sav
Chimney.sav	Disability.sav	Energy performance.sav	interview.sav	
Commac.sav	Dwelling.sav	Full sample equivalised income.sav		
Common.sav	Employment.sav	HHSRS.sav		
Damppc.sav	Energy.sav	Standardised costs.sav		
Doors.sav	Fire.sav			
Dormers.sav	Firstimp.sav			
Elevate.sav	HhldType.sav			
Firstimp.sav	Identity.sav			
Flatdets.sav	Income.sav			
Hhsrs.sav	Landlord.sav			
HQ.sav	Other.sav			
Interior.sav	Owner.sav			
Introoms.sav	People.sav			
Numflats.sav	ReasTnO.sav			
Plotlvl.sav	Renter.sav			
Roofcov.sav	Rooms.sav			
Rooffeat.sav	SecondHomes.sav			
Roofstru.sav	Vacant.sav			
Services.sav	WaitList.sav			
Shape.sav				
Shared.sav				
Structure.sav				
Wallfin.sav				
Wallstru.sav				
Windows.sav				

5.32 The data, user guides and supporting documentation are publicly available on the UK Data Archive (http://ukdataservice.ac.uk/). Datasets can be downloaded in SPSS and SAS format.

5.33 Prior to releasing the data in the UK Data Archive, all identifiable variables are removed to maintain the confidentiality of respondents. Some response categories are also condensed and several variables are top coded for disclosure control reasons.

Annex 5.1: HMO rules card

Determining Houses in Multiple Occupation ('HMOs')

The following supplementary questions will help determine whether the dwelling is an HMO. Count the number of "yes" responses to the **key questions** and **additional questions** then use the table below to determine whether the pattern of responses indicates that the dwelling is an HMO or instead identifies the dwelling as a single household/shared household (i.e. NOT an HMO).

Key questions (ranked in order):

1. Does the landlord find new tenants to fill any rooms that become vacant (as opposed to the remaining tenants fulfilling this function)?
2. Does the landlord bear the cost of any shortfall in rent if one or more tenants defaults or vacates (as opposed to the remaining tenants having to pay)?
3. Did the occupiers come to rent the house separately (as opposed to a single group of renters)?

Additional questions (not in any ranking order):

4. Do the tenants identify themselves as multiple households?
5. Is there a large group of occupiers (i.e. more than 5 persons)?
6. Is there a separate tenancy agreement for each occupant (as opposed to a joint tenancy)?
7. Do individual tenants keep their rooms locked, excluding other tenants from their accommodation?
8. Has there been a large turnover of occupiers since the commencement of the tenancy? (Say more than 40% over last 18 months.)
9. Is there a mix of different types of occupants at the premises? (e.g. they are not all students)

Pattern of responses	**Meaning**
6+ questions answered 'Yes'	= bed-sits (which collectively would form an HMO)
4-5 questions answered 'Yes' including at least 1 'key question'	= bed-sits (which collectively would form an HMO)
4-5 questions answered 'Yes' but not any 'key questions'	= single household/shared house (i.e. NOT an HMO)
Less than 4 questions answered 'Yes'	= single household/shared house (i.e. NOT an HMO)

Annex 5.2: List of derived variables

5.34 This Annex includes a full list of derived and geo-demographic variables, Annex Tables 5.2.1, 5.2.2 and 5.2.3. Further details on the derivation of these variables are available in the EHS Data Dictionary, publicly available on the UK Data Archive (http://ukdataservice.ac.uk/).

Annex Table 5.2.1: interview11+12.sav and interviewfs12.sav

accomhh	type of accommodation for household (interviewfs only)
accomhh1	type of accommodation for household & if not self-contained (interviewfs only)
agehrp2x	age of household reference person - 2 band
agehrp4x	age of household reference person - 4 band
agehrp6x	age of household reference person - 6 band
agehrpx	age of HRP - continuous
agen16	number of persons under 16 in household (interviewfs only)
ageoldbx	age of oldest person in household - banded
ageoldx	age of oldest person in household
agepartx	age of partner - continuous
ager	report age categories (interviewfs only)
AHCinceq	AHC equivalised weekly income (modified OECD scale)
AHCinceqv5	AHC equivalised income quintiles (weighted by peoplegross)
AHCinceqv60h	AHC: below 60% of median income (weighted by peoplegross)
ALLincx	annual gross income of the HRP and partner inc. income from housing benefit and LHA
amthbenx	weekly housing benefit
bedrqx	no. of bedrooms required by the household (2006 definition)
bedstdx	bedroom standard (2006 definition)
BHCinceq	BHC equivalised weekly income (modified OECD scale)
BHCinceqv5	BHC equivalised income quintiles (weighted by peoplegross)
BHCinceqv60h	BHC: below 60% of median income (weighted by peoplegross)
Buypresh	year HRP bought present accommodation (interviewfs only)
Cohabhrp	if HRP is cohabiting (interviewfs only)
Cohabprt	if HRP partner is cohabiting (interviewfs only)
emphrp3x	working status of HRP (primary) - 3 categories
emphrpx	employment status (primary) of HRP
empprt3x	working status of partner (primary) - 3 categories
empprtx	employment status (primary) of Partner
equityr	equity in home (based on respondent valuation only)
equityr5	equity in home (based on respondent valuation only)
ethhrp2x	ethnic origin of HRP - 2 categories
ethhrp4x	ethnic origin of HRP - 4 categories
ethhrp8x	ethnic origin of HRP - 8 categories
ethprt	ethnic group of hrp's partner (interviewfs only)
famnumx	number of family units in hhold
FreeLeas	freehold or leasehold
ftbuyer	iIf first-time buyer (interviewfs only)

GrossA	age group & sex of youngest person in household (interviewfs only)
hatentp	type of housing association tenancy (interviewfs only)
hhbensx	household on means tested bens or tax credits with a relevant income below the threshold
hhcomp1	household composition (interviewfs only)
hhcompx	household composition
hhempx	employment status of HRP and partner combined
hhinc5x	all households - income in 5 bands
hhincflg	imputations used to create net total hhold income
hhincx	EHS Basic Income (annual net household income (HRP + Partner) including savings)
hhltsick	anyone in hhold have < illness or disability?
hhsizex	number of persons in the household
hhtype11	househld type - full 11 categories
hhtype6	household type - 6 categories
hhtype7	household type - 7 categories
hhvulx	household vulnerable - on means tested or certain disability related benefits?
housbenx	household (HRP + partner) receives any housing benefit?
hpregdis	HRP or partner registered disabled?
HYEARGRx	household gross annual income (inc. income from all adult household members)
JOINTINCx	annual gross income of the HRP and partner
lenown	length of ownership (years)
lenownb	length of ownership to date of survey
lenres	length of residence (interview 11+12 only)
lenresb	length of residence
lenres2	length of residence
LHArqx	no. of bedrooms required by the household (2011 definition)
LHAstdx	bedroom standard (2011 definition)
loncoupx	single householder or with partner
market_rent	tenancy types of renters
mortwkx	weekly mortgage payments
nbatha	if shares a bathroom, shower room or WC (interviewfs only)
NBedsX	total no of bedrooms household actually has
ncouple	number of couples in household (interviewfs only)
NDEPCHILD	number of dependent children in household
NEmp	number of employed persons in household (interviewfs only)
NInac	number of economically inactive persons in household (interviewfs only)
nkita	if shares a kitchen (interviewfs only)
nliving	if shares other room (living room) (interviewfs only)
NLpar	number of lone parent families in household (interviewfs only)
NoUnits1	banded number of family units in household (interviewfs only)
nrooms1a	number of rooms available to household grouped (interviewfs only)
nroomsa	number of rooms available to household (interviewfs only)
nshare	if shares any part of accommodation (interviewfs only)
Nsing	number of one-person family units in household (interviewfs only)

nssech	NS-SEC Socio-economic Classification – HRP (interviewfs only)
nssecp	NS-SEC Socio-economic Classification - HRP's partner (interviewfs only)
NStud	number of students in household (interviewfs only)
NUnemp	number of unemployed persons in household (interviewfs only)
NXDEPCH	number of non-dependent children in household (interviewfs only)
olderx	no. of people aged 60 plus who are HRP or partner
otherfam	additional families present in household
othfamlp	type of additional families in household
Owntype	type of ownership
Prevten	previous Tenure (interviewfs only)
pyngbx	age band of youngest person in household
pyngx	age of youngest person in household
rentExS	total weekly rent excluding the cost of services
rentExSflg	rent excluding services changed/imputed
rentflg	rent/housing benefit changed/imputed
rentwkx	total weekly rent payable (rent plus housing benefit)
sexhrp	Sex of household reference person
sexprt	Sex of hrp's partner
SFT	number of FT workers in HHLD (interviewfs only)
sharer	if shares accommodation with other household (interviewfs only)
studhrp	if HRP is a full time student (interviewfs only)
Studprt	if HRPs Partner is a full time student (interviewfs only)
tenex	extended tenure of household
tenure1	tenure Group 1 (interviewfs only)
tenure2	tenure Group 2 (interviewfs only)
tenure3	tenure Group 3 (interviewfs only)
tenure4	tenure Group 4 (interviewfs only)
totkitsa	number of unshared kitchens (interviewfs only)
workless	household with no one of working age employed - ILO defn

Annex Table 5.2.2: physical11+12.sav

alltypex	dwelling age and type
area3x	type of area
arnatx	nature of area
attic	attic present in dwelling
basement	basement present in dwelling
boiler	type of boiler
constx	construction type
cstactbx	basic repair costs (actual)
cstactcx	comprehensive repair costs (actual)
cstactux	urgent repair costs (actual)
cststdbx	basic repair costs (per square metre)
cststdcx	comprehensive repair costs (per square metre)
cststdux	urgent repair costs (per square metre)
dampalf	dampness problems in one or more rooms
dampcdf	serious condensation in one or more rooms
damppnf	penetrating damp in one or more rooms
damprsf	rising damp in one or more rooms
dblglaz2	extent of double glazing
dblglaz4	extent of double glazing
dhcosty	cost to make decent (hhsrs model)
dhdisrx	decent homes repair criterion
dhhhsrsx	decent homes HHSRS 15 criterion
dhhhsrsy	decent homes HHSRS 26 criterion
dhmodx	decent homes modern facilities criterion
dhnumy	decent homes: number of criteria failed (hhsrs 15 model)
dhnumz	decent homes: number of criteria failed (hhsrs 26 model)
dhomesy	decent homes - HHSRS 15 model
dhomesz	decent homes - HHSRS 26 model
dhreasny	decent homes criterian not met (hhsrs 15 model)
dhreasnz	decent homes criterian not met (hhsrs 26 model)
dhtcacty	requirement to pass decent homes thermal comfort criterion
dhtcreasy	reason for failing decent homes on thermal comfort?
dhthermy	decent homes thermal comfort criterion
dwage4x	dwelling age
dwage5x	dwelling age
dwage6x	dwelling age
dwage9x	dwelling age
dwtype3x	dwelling type
dwtype7x	dwelling type
dwtype8x	dwelling type
dwtypenx	dwelling type
EPceeb09e	energy efficiency rating band (ehs SAP 2009)
EPceib09e	environmental impact rating band (ehs SAP 2009)

EPceir09e	environmental impact rating (ehs SAP 2009)
floor5x	useable floor area
floorx	useable floor area (sqm)
fuelx	main fuel type
heat4x	main heating system
heat7x	main heating system
housex	dwelling type
loftins4	loft insulation thickness
loftins6	loft insulation thickness
loftinsu	loft insulation thickness with unknowns
loftinsx	loft insulation thickness
loftu4	loft insulation thickness with unknowns
lv1upkpx	poor quality environment - upkeep problems
lv2trafx	poor quality environment - traffic problems
lv3utilx	poor quality environment - utilisation problems
lvanyx	poor quality environment
lvnumx	number of liveability problems present
mainfuel	Main heating fuel
neivisx	Appearance of area
parking	parking provision of survey dwelling
pcavwallx	percentage of external wall area that is cavity masonry
sap09	energy efficiency (SAP09) rating
sap409	energy efficiency (SAP09) rating
secure	secure windows and doors
storeyx	number of floors above ground
sysage	age of heating system
tenure2x	tenure
tenure4x	tenure
tenure8x	tenure
typercov	predominant type of roof covering
typerstr	predominant type of roof stucture
typewfin	predominant type of wall finish
typewin	predominant type of window
typewstr2	predominant type of wall stucture
wallcavx	type of wall
wallinsx	type of wall and insulation
watersys	water heating system
wins90x	type of wall - post 1990 assumption

Annex Table 5.2.3: general11+12.sav and generalfs12.sav

aagfh12	household weight (2012-13) (generalfs12 only)
aagpd1112	dwelling weight, paired case 2012 (general11+12 only)
aapgh1112	household weight, paired case 2012 (general11+12 only)
fmonth	fieldwork month (generalfs12 only)
fqtr	fieldwork quarter (generalfs12 only)
fyear	fieldwork Year
GorEHCS	government office region
GorEHS	government office region - EHS order
govreg1	government office Region, grouped (generalfs12 only)
imd1010	IMD 2010 decile ranking of areas (lower layer SOA)
paired	whether paired sample case (generalfs12 only)
region3x	overall region of England
rumorph	Rurality classification - morphology (COA)
rucontxt	Rurality classification - context (COA)
rucombin	Rurality classification - combined (COA)
tenure2x	tenure
tenure4x	tenure
tenure8x	tenure
vacantx	Type of vacancy (general11+12 only)
vaclngth	Length of vacancy (general11+12 only)

Annex 5.3: Accessibility indicators

5.35 The EHS collects a good deal of information on whether dwellings possess certain features or attributes to make them more accessible and useable for people with disabilities. In reporting, it focuses on the four aspects that form the basis of the requirements in part M of the Building Regulations, although the EHS cannot exactly mirror the detailed requirements:

- **Level access to main entrance:** there are no steps between the pavement (or any gate) and the entrance door. The path also has a gradient of less than 1:20. Includes level access to the entrance of the survey module for flats with common areas. Level access is analysed for dwellings with a private or shared plot.
- **Flush threshold to main entrance:** the threshold to the main entrance door has no obstruction greater than 15mm. This prevents the threshold from being a trip hazard and allows a wheelchair user to easily enter through the main door.
- **Width of internal doorways and circulation space conforms to Part M:** complies with requirements of Building Regulations.
- **WC at entrance level:** any WC at entrance level as EHS does not indicate whether it is wheelchair accessible.

5.36 A home is considered to be fully 'visitable' if it has all of the four features listed above. All these features are assessed directly by the surveyors during the physical survey according to a set of detailed guidelines which are detailed in Annex Table 5.3.1.

Annex Table 5.3.1: Four visitability features

<table>
<tr><th>Criterion</th><th>Definition</th></tr>
<tr><td>Level access to main entrance</td><td>Surveyors record the number of steps from the front gate/ pavement to the entrance to the dwelling. A ‘step’ is any planned change in level, excluding the width of the cill at the bottom of the door. Surveyors will only record level access where there are no steps between the gate / pavement and the entrance door to the dwelling for a wheelchair to negotiate. The path must also have a gradient of less than 1 in 20.</td></tr>
<tr><td>Flush threshold</td><td>This is only recorded as present if a wheelchair can be wheeled straight into a dwelling with no step to negotiate or obstruction higher than 15mm. For houses, this will usually be a specified adaptation. For flats, it is the entrance doorway into the flat itself that is assessed. Purpose-built flats are much more likely to have been built with a flush threshold to the entrance door or the flat. Flats on upper or basement floors can be assessed as having a flush threshold if the journey from the entrance to the module to the inside of the dwelling can be negotiated using a suitable lift and there is no step or obstruction higher than 15mm. If the lift is not working, the flat will still have a flush threshold.</td></tr>
<tr><td>The width of internal doorways and hallways conforms to Part M</td><td>This is only recorded as satisfactory if the doors and circulation space serving habitable rooms, kitchen, bathroom or WC comply with Part M regulations, as follows:
<table>
<tr><th>Doorway clear opening width (mm)</th><th>Corridor/passageway width (mm)</th></tr>
<tr><td>750 or wider</td><td>900 (when approach head-on)</td></tr>
<tr><td>750</td><td>1200 (when approach not head-on)</td></tr>
<tr><td>775</td><td>1050 (when approach not head-on)</td></tr>
<tr><td>800</td><td>900 (when approach not head-on)</td></tr>
</table></td></tr>
<tr><td>WC at entrance level</td><td>The WC must be located on the same level as the entrance to the house or flat and must be located inside the dwelling.</td></tr>
</table>

5.37 The survey also collects a range of additional data, which can be modelled to provide additional information on the accessibility of the dwelling, for example:

- living room at ground floor or entrance level or space to provide one
- bedroom at ground floor or entrance level or space to provide one
- space for turning wheelchairs in kitchens, dining areas and living rooms

- bath/shower at entrance level

5.38 A detailed report on the accessibility of the housing stock and its ease of adaptability for independent living can be found in the EHCS 2007 Annual Report and further technical details can be found in Chapter 11 of the EHCS 2007 Technical Report: (http://webarchive.nationalarchives.gov.uk/20120919132719/www.communities.gov.uk/publications/housing/ehcstechnicalreport2007).

Annex 5.4: Household derived indicators

5.39 This Annex focuses on the more complex derived household variables created using EHS interview survey data where the home is occupied and covers the following variables:

- income
- equivalised income
- rents and housing benefit
- modelling of mortgage repayments
- equity

5.40 These complex derived household variables, along with more straight forward household variables e.g. household composition, age of the household reference person (HRP) etc, are used throughout the EHS Reports. They are used in the Households Report, which present results on household circumstances and attitudes to housing, the Profile of English Housing, which present results on the condition, amenities and services, the Energy Efficiency of English Housing and the Fire and Fire Safety Reports.

5.41 Checks are made on the derived variables to ensure as far as possible that the data values are reasonable and that missing data have been assigned correctly. Implausible values are investigated and only when it is as certain as possible that the data are incorrect is a change made. To assist in analysis, changes made to the data are flagged in the derived EHS interview variable dataset indicating the nature and extent of any imputation.

5.42 All interview based variables are derived from the full annual EHS sample. The EHS Households and Fire and Fire Safety Report are based mainly on one full annual EHS sample, whereas the EHS Profile of English Housing and Energy Efficiency of English Housing Reports are mainly based on two years of data using the paired household sub-sample (i.e. where an EHS household interview survey and a physical inspection of the property are secured).

5.43 The EHS datasets containing these household variables are available to users via the UK Data Archive www.data-archive.ac.uk/

Income

5.44 The EHS Reports present household/housing related characteristics in relation to various income indicators.

5.45 The income indicators used within the EHS Reports are based on the annual income of the HRP and their partner from wages, pensions, savings, and state benefits. The interview survey collects information on the main components of income for the HRP and their partner. These include:

- earnings from regular employment (including government training scheme income) or as self-employed

- income from occupational and private pensions
- income from other private sources such as rent from lodgers, student loans, maintenance payments etc
- state benefits including state pensions
- income from savings and investments

5.46 The income data are thoroughly checked for inconsistencies and errors to make sure as far as possible that the data are reasonable and that missing data has been imputed correctly. Implausible values are interrogated and only changed when it is almost certain that the data are incorrect. Any changes made are flagged indicating the nature and extent of any imputation (variable hhincflg).

5.47 Where respondents report receipt of private income sources, e.g. employment, self-employment income, but are unable/refuse to specify an amount, then an estimated amount is assigned according to the methods outlined in Annex Table 5.4.1.

Annex Table 5.4.1: Imputation procedure for private sources

	Type of missing data	**Method of imputation**
Self-employed	Amount missing	Uses data from the Annual Survey of Hours and Earnings (ASHE) based on age, sex, part-time/full-time, social economic group and geographical location
Regular employment	Amount missing	
Occupational pension	Amount missing	Sample median based on sex and social economic group
Private pension	Amount missing	
Other private sources	Amount missing	Sample median based on working status

5.48 Average values are based on the sample median rather than the sample mean as use of median values better reflects the characteristics of skewed distributions such as are common with income data.

5.49 Where respondents state receipt of particular types of benefits but are unable/refuse to specify an amount, an estimate is inserted based on their theoretical entitlement to the particular benefit. The EHS interview survey incorporates checks on the missing benefit amounts to ascertain whether this were due to the inclusion of the missing amounts with other specified benefits. Use of this data is incorporated into the assessment of missing benefit incomes to avoid double counting of benefit income where this looks

probable. Only households that state they are in receipt of benefits are allocated income from benefits. If they are entitled to other benefits but are not claiming them, then estimates for these are not included.

5.50 Information is also collected on savings of the HRP and partner. Where the amount of savings/investment has not been provided, a method based on CHAID analysis is used to estimate the combined savings/investment of the HRP and any partner using predictor variables such as tenure, age/sex of HRP, number of jobs (HRP plus any partner) etc.

5.51 When the annual net income measure needs to be derived, Income Tax and National Insurance payable for the HRP and their partner are calculated where applicable according to Income Tax and National Insurance rates and allowances and deducted to give the total net annual income of the HRP and partner.

5.52 Low incomes in the dataset are uplifted, the justification being that it is likely the respondent under reported their income, either deliberately or by mistake. Where the calculated income of the HRP and any partner is lower than the household's calculated basic theoretical income support/pension credit entitlement, the income amount is changed as follows. Households in receipt of one or more of the main benefits (excluding child benefit) and with an income below their theoretical income support/pension credit entitlement are allocated their basic income support/pension credit level plus any disability premiums that they might qualify for. Households that are not in receipt of any of the main benefits and with an income below their theoretical income support/pension credit entitlement have their income initially set to missing as it was assumed key components of income had been missed or seriously under-reported. An imputed value is then derived – see below.

5.53 Households where the total HRP and partner income is missing have this estimated using the median income for households as defined by working status, social economic group and whether a partner of the HRP is present in the household.

5.54 There are two versions of the variable for the annual income of the HRP and any partner. One variable is in terms of gross income i.e. income before tax and National Insurance deductions (labelled JOINTINCx) and the other in terms of net income i.e. with the deduction of Tax and National Insurance where applicable (labelled hhincx). It should be noted that these two income variables do not include any housing related benefits/allowances.

5.55 In addition, a variable giving the gross income of the HRP and partner has been created that includes housing benefit/Local Housing Allowance as income (labelled 'ALLincx'). This variable is derived by simply adding together the annual gross income of the HRP and partner (JOINTINCx) and an annualised housing benefit/LHA amount (amthbenx * 52). See the section on 'Rents and housing benefit' for the calculation of housing benefit/LHA using EHS data.

5.56 There is also a further gross income variable available, labelled HYEARGRx which is an extension of the gross income of the HRP and any partner. This variable represents the household gross income of the HRP and any partner but also includes the gross income of other adults living within the household that are not part of the primary benefit unit3 e.g. a grown-up child living with their parents or two or more unrelated individuals sharing a house. Note that this income variable does not include any housing related benefits/allowances.

5.57 The EHS Reports tend to refer to income in terms of the gross income of the HRP and partner. This is used throughout the Households Report (and associated tables) to relate household income to factors such as tenure and housing benefit receipt. An 'equivalised' income measure is also sometimes used within the EHS Reports. This is an extension of the net income measure outlined in this section and is discussed in detail below.

Equivalised income

5.58 A measure known as 'in poverty' is reported on in the EHS Reports and associated tables. This is based upon an income measure that is 'equivalised' before housing costs are taken into account. All analysis makes clear the precise measures being used.

5.59 The purpose of income equivalisation is based on the concept that the cost of living varies according to size and type of household. It recognises that, for example, a household of three people requires a higher income than a one person household to achieve the same standard of living. Accordingly an equivalence scale (the modified OECD[4] scale) is employed, taking each household's size and composition into account, to make sensible comparisons.

5.60 Equivalised income measures have been constructed for the EHS in order to assess the relationship between relative poverty and housing conditions and amenities, not to provide estimates of poverty as such. Across Government, poverty is assessed principally through the Households Below Average Income (HBAI)[5] series. Information on household incomes is not collected in as much detail by the EHS as it is by the Family Resources Survey (the data source for the HBAI series). Therefore there are some limitations to which components can be included in the income measures produced for the EHS. Annex Tables 5.4.2, 5.4.3, 5.4.4 list the HBAI components of the BHC and AHC measures and describe how the information is addressed through the EHS.

[3] Additional adult household members reported during the EHS interview survey to be living in halls of residence are excluded from the analysis and their income is not considered to be part of the household.
[4] Organisation for Economic Co-operation and Development
[5] http://statistics.dwp.gov.uk/asd/index.php?page=hbai

Annex Table 5.4.2: BHC Income components in HBAI and EHS

HBAI Income component	Treatment in the EHS
Income from all household members	The EHS collects income data for the Primary Benefit Unit from the respondent (HRP or any partner). Income data for any additional adult household members is also collected.
Net earnings from employment	Collected
Profit or loss from self-employment	Self-employment income is collected in the EHS and it is included as an income component. The EHS does not collect information on negative self-employment income amounts (i.e. if the respondent experienced a self-employment loss) and thus income losses are not included.
Social security benefits and Tax Credits	Collected for the HRP and any partner
Income from occupational and private pensions	Asked about explicitly in EHS interview
Investment income	Collected
Maintenance payments	Would only be picked up as an 'other' source of income
Income from educational grants and scholarships	Would only be picked up as an 'other' source of income
Cash value of certain forms of income in kind	Not collected

Annex Table 5.4.3: BHC deductions in HBAI and EHS

HBAI BHC Income deduction	Treatment in the EHS
Income tax payments	Deducted using standard rules
National Insurance contributions	Deducted using standard rules
Council tax	Deducted based on information from the council tax band for the property and the council tax rate from the local authority
Contributions to occupational pension	Not collected
Insurance premium payments made in case of sudden loss of earnings	Not collected
Maintenance and child support payments	Not included
Parental contributions to students living away from home	Not collected
Student loan repayments	Not collected

Annex Table 5.4.4: AHC deductions in HBAI and EHS

HBAI AHC Income deduction	Treatment in the EHS
Rent	Collected
Water rates, community or council water charges	Not collected
Mortgage interest payments	Some mortgage data collected but not in sufficient detail to be able to derive an accurate mortgage interest variable. Total mortgage repayments used as a proxy.
Structural insurance premiums	Not collected
Ground rent and service charges	Not included

5.61 The HBAI report uses two different equivalised income measures: Before Housing Costs (BHC) and After Housing Costs (AHC). The income components that make up the EHS equivalised BHC income variable include: net income of the HRP and any partner, net income from additional adults in the household, modelled winter fuel payment and the addition of council tax

benefit and housing benefit/Local Housing Allowance. For each household the BHC income measure adds up the income from these specified sources and then deducts the amount of council tax payable. These income sources are outlined in Annex Table 5.4.5 together with the method of calculating each income component. The AHC is derived by deducting rent and mortgage payments from the BHC measure, as outlined in Annex Table 5.4.6.

Annex Table 5.4.5: Income components of the BHC equivalised income

Components of the BHC income measure	Method of calculating the income component
Net income of the HRP and any partner	The income variable hhincx is used. See the section above on 'Income'.
Net income from additional adults in the household	The EHS interview survey collects income data at a basic level for all household members that are 16 or over which is converted to a net amount by deducting the applicable Income Tax and National Insurance
Winter Fuel Payment	The applicable amount of WFP for the household is modelled based on the number of household members that have reached the qualifying age for WFP
Council tax benefit	The BHC income measure includes income from council tax benefit. The EHS interview survey collects information on council tax benefit receipt of the HRP and any partner. Council tax benefit is assigned based on this information combined with knowledge of theoretical eligibility and the amount of council tax due.
Housing benefit/Local Housing Allowance (LHA)	The BHC income measure includes income from Housing benefit/LHA. See the section on 'Rents and housing benefit' for the calculation of housing benefit/LHA using EHS data. The derived variable amthbenx is used.
Deduction of council tax payable	The BHC income measure deducts council tax paid by the household. The amount of council tax paid by the household is modelled using the council tax band of the dwelling and

	information about charges in the relevant local authority area. The council tax band for each dwelling is collected via a data matching exercise undertaken by the Valuation Office Agency. The council tax band information is only for use in the production of statistics.

Annex Table 5.4.6: Income components of the AHC equivalised income

Components of the AHC income measure	Method of calculating the income component
Deduction of rent	The AHC income measure deducts the amount of rent paid by the household (if applicable). See the section on 'Rents and housing benefit' for the calculation of rent using EHS data. The derived variable RentExS is used.
Deduction of mortgage payment	The AHC income measure deducts the mortgage payments paid by the household (if applicable). See the section on 'Mortgage Payment' for the calculation of mortgage payments using EHS data. The derived variable mortwkx is used.

5.62 The HBAI series and poverty estimates are based on a modified OECD scale (modified so that a couple with no children is considered the reference point and has an equivalence factor equal to unity). The EHS follows this approach and determines the number of 'first' adults (i.e. HRP), other adults, children aged 14 years and over and children under 14 for each sample case in the dataset. This provides the necessary information to be able to apply the OECD equivalisation factors in order to produce an equivalised income, Annex Table 5.4.7.

Annex Table 5.4.7: OECD equivalisation factors

Equivalence scales	Modified OECD scaled to couple without children = 1	
	BHC	AHC
First adult	0.67	0.58
Spouse	0.33	0.42
Subsequent adults	0.33	0.42
Children aged under 14 years	0.20	0.20
Children aged over 14 years	0.33	0.42

Note: additional adult household members reported during the EHS interview survey to be living in Halls of Residence are excluded from the analysis.

5.63 The measured household income is divided by this equivalisation factor so that any household with a factor of less than one (e.g. a single person household) will have their income inflated, reflecting the fact that they are relatively better off than a larger household with the same income. Households with a factor greater than one have their incomes reduced, reflecting the fact that they are relatively worse off than a smaller household. The incomes of households containing two adults without children will not change.

5.64 The EHS Reports often use the BHC equivalised weekly income measure ranked and grouped into five equal sized categories. Thus the first quintile relates to the households with the lowest 20% of BHC equivalised weekly incomes and the fifth quintile relates to the households with the highest 20% of BHC equivalised weekly incomes. As previously mentioned, a term referred to as 'in poverty' is also used in the EHS Reports Households are defined to be 'in poverty' if their equivalised income is below 60% of the median household income before housing costs (BHC) are taken into account.

Rents and housing benefit

5.65 Information on rents and housing benefit are presented in detail in the EHS Households Report in analysis of social and private renters. The amount of rent and housing benefit also feeds into the calculation of Equivalised income (see above).

5.66 Household rents and housing benefit receipt are collected in the EHS interview survey and apply only to households that rent their own home or households in a shared ownership scheme. Renting households that live rent-free are not asked the series of rent and housing benefit questions in the interview survey. For rent-free cases the rent and housing benefit amounts are set to zero.

5.67 The total weekly rent payable for the property (variables rentwkx) includes the rent paid by the householder plus any housing benefit/Local Housing Allowance (LHA) received (variable amthbenx). These variables are calculated based on the householder's response to the set of detailed rent and housing benefit questions asked in the EHS interview. For households with a rent holiday, an adjustment is made so that the actual total amount of rent/housing benefit paid over the course of the year (over n weeks) is averaged out over the full year (as if paid over 52 weeks).

5.68 Households that pay rent but do not provide an amount for their rent/housing benefit, because the amount was either unknown or refused, are assigned an estimated total weekly guide rent amount. This is based on tenure, number of bedrooms and area where they live, (for private renters variables such as the type of landlord and level of furnishing are also used in the imputation), using the sources of rent data outlined in Annex Table 5.4.8. For these cases, the estimated total weekly rent payable (rentwkx) is calculated by adding the total weekly guide rent to the estimated modelled amount for services e.g. heating and regular meals etc. that are included in the rent (where applicable as specified by the householder). See paragraphs 33 to 35 for more information on services.

Annex Table 5.4.8: Data sources used for missing rent amounts

Tenure of the renting household	Type of missing data	Rent data source for missing values
Local authority	Rent amount missing	DCLG Local Authority Housing Statistics is used in conjunction with EHS data using the year in question and modelled accordingly
Housing association and shared owners	Rent amount missing	Two successive years of data is drawn from the Statistical Data Return submitted by Private Registered Providers (to reflect a mid-year rent value)
Private renters	Rent amount missing	EHS data using the year in question and modelled accordingly

5.69 Households that receive housing benefit/LHA but do not provide an amount or households that do not know if they receive housing benefit/LHA are assigned an estimated housing benefit/LHA amount as follows:

- If the household states that they are in receipt of full housing benefit/LHA then the weekly housing benefit is set to their theoretical guide rent amount (as opposed to the total weekly rent payable, since housing benefit does not cover the cost of services such as heating and regular meals)
- If the household states that they are in receipt of partial housing benefit/LHA or if they do not know if their housing benefit/LHA covers all or some of their rent then an amount of housing benefit/LHA is imputed based on their total rent amount payable and their theoretical entitlement to housing benefit

5.70 An extension of the derived variable for total weekly rent payable for the property (labelled rentwkx) is the total weekly rent payable for the property excluding the cost of services e.g. heating, council tax etc (labelled rentExS). The EHS interview survey asks the householder if the rent amount included any of the following services:

- Council tax
- heating
- water and sewerage
- lighting
- hot water
- fuel for cooking
- regular meals
- TV licence

5.71 If the amount of rent the householder provided does not include any of these services, then the total weekly rent payable for the property is the same as the total weekly rent payable for the property excluding the cost of services i.e. rentwkx equals rentExS.

5.72 If the rent amount provided by the householder does include one or more of the services stated above then the householder is asked to provide a rent value excluding the selected services. Based on this rent information, an amount is calculated for total weekly rent payable for the property, excluding the cost of services. If a rent amount excluding services is not provided by the householder then an estimated amount for the selected services is modelled according to the methods shown in Annex Table 5.4.9 in order to derive a rent amount excluding the cost of services.

Annex Table 5.4.9: Imputation procedure for service amounts

Service	Method of imputation
Council tax	The amount is derived using the council tax band information for the property and the council tax rate from the local authority. For any cases where the respondent selects that council tax is included in their rent but also selected full housing benefit then the amount is set to 0.
Water and sewerage	This is calculated using the mean average water and sewerage rate for a household in England for the given year multiplied by a dwelling factor (that reflects the size/type of property) multiplied by a factor for that geographical area
Heating	Amounts are calculated based on DWP deductions from rent (as used in the assessment of housing benefit)
Lighting	
Hot-water	
Fuel for cooking	
Regular meals	
TV license	Based on the cost of a colour TV license (the TV license fee is set to zero where the HRP/partner is 75 years or over)

5.73 The EHS Households Report mainly focuses on the weekly rent amount payable for the property, excluding the cost of services, e.g. heating, council tax etc. Between the 2007-08 and 2008-9 data there were some methodological changes to the way in which rent data were processed in the EHS compared to the previous Survey of English Housing (SEH). These changes are detailed in the EHS Households Report 2008-09 where an assessment of the impact of the methodological changes between 2007-08 and 2008-09 on the private rent estimates and further details of the changes to the calculation of social rents are provided.

5.74 The rent and housing benefit amounts are thoroughly checked for inconsistencies and errors to make sure as far as possible that the data is reasonable and that missing data has been imputed correctly. Implausible values are interrogated and only changed when almost certain that the data is incorrect. Any changes made are flagged indicating the nature and extent of any imputation (variables rentflg and rentExSflg).

Modelling of mortgage repayments

5.75 Mortgage repayments are calculated from raw data collected from respondents on payments for all mortgages/loans secured on the dwelling, deducting any notional amounts for building and contents insurance, mortgage protection, and other insurance payments where they have been accidentally included. Endowment policy premiums are included in repayments. Information collected is converted to weekly amounts (variable mortwkx).

5.76 Where repayment amounts are unknown or missing, data is imputed. Where alternative data is available, using the formula below for monthly mortgage repayment:

$$\frac{\text{(value of current main mortgage x annual interest rate/12)}}{(1-1/((1+\text{annual interest rate}/12)^{(\text{length of main mortgage in months})}))}$$

5.77 The 'current main mortgage' refers to the highest value mortgage if there is more than one loan secured on the property. Where the value of the current main mortgage is not provided, it is derived from original purchase price minus deposit paid, if these data are available. The purchase price is imputed if unknown, based on current market value, year dwelling bought (if available) and DCLG annual house price inflation indices for each area. From 2010, the EHS ceased collecting current market valuations from the Valuation Office Agency (VOA) for all households participating in the interview survey who had a physical inspection of their dwelling. In the interview survey, households are now asked to provide a recent (in last 12 months) valuation of their dwelling, and, if not available, their own estimate of the market value. This valuation/estimate is now used as a proxy for current market value. Any missing values are imputed using data from the Regulated Mortgage Survey based on dwelling type and geographical area. Valuations are checked for outliers and corrected if possible to determine. Payments for other loans secured on the property are not included in this imputation process.

5.78 If the length of the main mortgage is unknown, it is modelled where data are available, based on the age of HRP and when the main mortgage was taken out (or if missing, when the dwelling was bought), assuming a maximum mortgage length of 25 years and that it will be paid off when the HRP is 60 years old.

5.79 The annual interest rate is taken from monthly data provided by the council of mortgage lenders (CML). An average is calculated for the period covered by the EHS survey.

5.80 Monthly mortgage payments are set to not applicable (-9) for tenancies. If the owner owns the dwelling outright, payments are zero. Shared owners are treated as owners and mortgage payments are derived as above. Flexible/all in one/offset mortgages are also derived as above. Payments for equity release mortgages are modelled as above.

5.81 Monthly repayment amounts are then converted to weekly payments. The data are thoroughly checked for inconsistencies, outliers and errors although data are only corrected where totally implausible and it is possible to determine an alternative more reliable imputed value.

Equity

5.82 The value of a household's equity in their property is calculated for all owner occupied (including shared owner) households who participate in the interview survey. It is based on the current market value of the property minus the amount of mortgage outstanding.

ie. Equity = current market value – amount of mortgage outstanding including other loans on the property

5.83 All owner occupiers are asked in the interview for an estimated current valuation of their property. This is used to derive an approximate equity value as detailed above (variables 'equityr' and 'equityr5').

5.84 Research has demonstrated that owner occupiers are more likely to overestimate the value of their homes than underestimate it, and only 40% of household estimates are within 10% of the VOA valuation. Those who moved in just over a year ago, are on the highest incomes or in the highest value properties are most likely to overestimate value. Those homes most likely to be underestimated contain singletons and couples aged over 60 and those resident for at least 20 years. As a result of respondents tending to overestimate property value, equity based on this source of market value ('equityr' and 'equityr5') is likely to be an overestimate.

5.85 Missing equity valuations are imputed using data from the regulated mortgage survey based on dwelling type and area. Valuations are checked for outliers and corrected if it is possible to determine a more reliable imputed value.

5.86 Where data used in the above formula is not available, equity is set to unknown (-88888888) or not applicable (-99999999) for tenancies.

Annex 5.5: Housing and Neighbourhood Conditions

5.87 The EHS collects very detailed information about the overall condition and quality of the housing stock using a detailed physical inspection by trained surveyors. A number of the simpler measures and indicators e.g. presence of damp problems, age of kitchen etc. are either self-explanatory or covered in the glossary to the main reports. The section provides more information regarding five more complex housing condition measures:

- the Housing Health and Safety Rating System
- decent homes
- disrepair
- accessibility
- poor quality environments

Housing Health and Safety Rating System

5.88 This section presents an overview of the Housing Health and Safety Rating System (HHSRS) and how the various hazards are measured and modelled using data from the EHS. It is divided into three sections:

- what is the HHSRS?
- how does the EHS measure and model Category 1 hazards?
- data quality and reliability

What is the HHSRS?

5.89 The HHSRS is the government's evidence based risk assessment procedure for residential properties. It replaced the Housing Fitness Regime on the 6 April 2006 in England. The HHSRS also replaces the Fitness Standard as an element of the Decent Homes Standard. The HHSRS is a means of identifying defects in dwellings and of evaluating the potential effect of any defects on the health and safety of occupants, visitors, neighbours and passers-by. The system provides a means of rating the seriousness of any hazard so that it is possible to differentiate between minor hazards and those where there is an imminent threat of major harm or even death. The emphasis is placed on the potential effect of any defects on the health and safety of occupants, visitors, and particularly vulnerable people. Altogether 29 hazards are included, Annex Table 5.5.1.

Annex Table 5.5.1: The 29 hazards covered by HHSRS

Physiological requirements

- dampness and mould growth
- excess cold
- excess heat
- asbestos (and MMF)
- biocides
- carbon monoxide and fuel combustion products
- lead
- radiation
- uncombusted fuel gas
- volatile organic compounds

Psychological requirements

- crowding and space
- entry by intruders
- lighting
- noise

Protection against infection

- domestic hygiene, pests and refuse
- food safety
- personal hygiene, sanitation and drainage
- water supply

Protection against accidents

- falls associated with baths etc
- falling on level surfaces
- falling on stairs etc
- falling between levels
- electrical safety
- fire
- flames, hot surfaces etc
- collision and entrapment
- explosions
- position and operability of amenities etc
- structural collapse and falling elements

5.90 The HHSRS scoring procedure uses a formula to generate a numerical hazard score for each of the hazards identified at the property – the higher the score, the greater the severity of that hazard. Potential hazards are assessed in relation to the most vulnerable class of person who might typically occupy or visit the dwelling. For example, for falls on stairs and falls on the level, the vulnerable group is defined as persons over 60 years, and for falls between levels it is children under 5 years old.

5.91 The hazard score formula requires the HHSRS inspector to make two judgements.

- the likelihood of an occurrence which could result in harm to a vulnerable person over the following 12 months. The likelihood is to be given as a ratio – e.g., 1 in 100, 1 in 500, etc.
- the likely health outcomes or harms which would result from the occurrence. From any occurrence there may be a most likely outcome, and other possible ones which may be more or less severe. For example, a fall from a second floor window could result in a 60% chance of a severe concussion, but there may also be a 30% chance of a more serious injury and a 10% chance of something less serious. The four classes of harms and the weightings given to them are listed in Annex Table 5.5.2.

Annex Table 5.5.2: Classes of harms and weightings used in the HHSRS

Class	Examples	Weightings
Class I	Death, permanent paralysis below the neck, malignant lung tumour, regular severe pneumonia, permanent loss of consciousness, and 80% burn injuries.	10,000
Class II	Chronic confusion, mild strokes, regular severe fever, loss of a hand or foot, serious fractures, very serious burns and loss of consciousness for days.	1,000
Class III	Chronic severe stress, mild heart attack, regular and persistent dermatitis, malignant but treatable skin cancer, loss of a finger, fractured skull, severe concussion, serious puncture wounds to head or body, severe burns to hands, serious strain or sprain injuries and regular and severe migraine.	300
Class IV	Occasional severe discomfort, chronic or regular skin irritation, benign tumours, occasional mild pneumonia, a broken finger, sprained hip, slight concussion, moderate cuts to face or body, severe bruising to body, 10% burns and regular serious coughs or colds.	10

5.92 From the judgements made by the HHSRS inspector, a hazard score can be generated for each hazard, Annex Table 5.5.3.

Annex Table 5.5.3: Calculation of HHSRS hazard score

Class of Harm Weighting			**Likelihood 1 in**		**Spread of Harm (%)**		
I	10,000	÷	100	X	0	=	0
II	1,000	÷	100	X	10	=	100
III	300	÷	100	X	30	=	90
IV	10	÷	100	X	60	=	6
				Hazard	**Score**	**=**	**196**

5.93 To provide a simple means for handling and comparing the potentially wide range of scores and avoid placing too much emphasis on the exact numbers, a series of ten hazard score bands have been devised, Annex Table 5.5.4. Bands A, B, and C are the most serious and grouped together as presenting a Category 1 hazard; local authorities have a statutory duty to consider some form of action where these are present.

Annex Table 5.5.4: HHSRS hazard score bands

Band	Equivalent Hazard Scores
A	5,000 or more
B	2,000 – 4,999
C	1,000 –1,999
D	500 – 999
E	200 – 499
F	100 – 199
G	50 – 99
H	20 – 49
I	10 – 19
J	9 or less

5.94 DCLG, and others, have published a number of guidance documents for HHSRS practitioners and private landlords. For guidance published by DCLG see:http://webarchive.nationalarchives.gov.uk/20120919132719/http://www.communities.gov.uk/documents/housing/pdf/142631.pdf

How does EHS measure and model Category 1 hazards?

5.95 For the EHS, surveyors are required to collect a wide range of information in what is a relatively short and non-intrusive property inspection. The survey cannot therefore replicate in full the HHSRS assessment that would be carried out by a local authority environmental health practitioner. The approach used has been developed by the Building Research Establishment working in close co-operation with experts from the University of Warwick who were involved in the development of the HHSRS methodology.

5.96 Of the 29 HHSRS hazards only three (which occur very rarely in the stock) are not assessed by the EHS. These are asbestos (and manufactured mineral fibres), biocides and volatile organic compounds.

5.97 The EHS uses three different methods to assess whether any of the 26 Category 1 hazards exist in dwellings:

- fully measured hazards as part of the physical survey for the most common types of hazards. The surveyor first assesses whether the risks presented for each of these hazards are significantly worse than average for the age and type of dwelling concerned. If this is the case, they then score both a likelihood of an incident occurring and the expected range of outcomes. An actual HHSRS score is not computed in the field but where risks are assessed as significantly worse than average surveyors obtain this score later during validation of their survey data prior to submission. From April 2012, EHS surveyors fully measured six hazards
- hazards flagged only when an 'extreme' risk is found as part of the physical survey. This approach is used for some of the rarer hazards where surveyors are instructed that 'extreme risk' equates to a Category 1 hazard. From April 2012, EHS surveyors assessed 16 hazards by this approach

- 4 hazards modelled post fieldwork from other data collected on the physical survey form. This approach is used where the surveyor is less able to directly assess the risk from these hazards.

5.98 Annex Figure 5.5.1 shows a worked example of HHSRS assessment. In making their HHSRS assessments surveyors are instructed to ignore the current occupancy and assume a member of the group most vulnerable to the particular hazard occupies the property. Annex Table 5.5.5 shows how information on each hazard is collected.

Annex Figure 5.5.1: Worked example of HHSRS assessment

FALLS ON STAIRS ETC

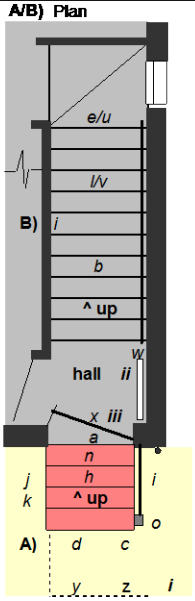
HHSRS VERSION 2

Vulnerable group Persons aged 60 years or over
Related hazards None

Multiple locations Yes No
Secondary hazards Yes No

A) Front door steps

A/B) Plan



B) Main stairs

C) Steps at gate

DESCRIPTION OF HAZARD/S

Dwelling: 1930s, Semi-detached house

A) **Front door steps:** These are of smooth painted concrete and have no top 'landing'. The bottom riser is high and uneven (300 mm max). There is a wobbly tubular steel handrail on one side but no guarding at all, despite the narrow width. There is no external porch light and little street lighting.

B) **Main stair:** The main internal stairs have two winders at the top and are moderately steep. There is a handrail only along the outside wall of the straight flight. There is a projecting radiator in the small hall and some glass in the front door close to the foot of the stairs.

C) **Steps at gate:** The steps close to the front gate are of rough spalling concrete. They have high uneven risers and a narrow tread. There is a crude rotten timber handrail but no guarding.

LIST OF RELEVANT MATTERS

LIKELIHOOD		A	B	C
a	Tread lengths	1	1	2
b	Riser heights	3	1	2
c	Variation in T&Rs	3	1	2
d	Nosing length	-	-	-
e	Poor friction quality	3	-	1
f	Openings - in stairs	-	-	-
g	Alternating treads	-	-	-
h-i	Lack/height handrails	3	2	2
j-l	Lack/height guarding	3	-	1
m	Stair width	2	-	-
n	Length of flight	-	1	-
o-q	Inadequate lighting etc	3	-	3
r	Door/s onto stairs	-	-	-
s	Inadequate landing	3	-	-
t	Construction/repair	2	-	3
u	Thermal efficiency	2	-	1

OUTCOMES		A	B	C
a	Length of flight	-	1	-
b	Pitch of stairs	-	2	-
c	Projections etc #	-	2	3
d	Hard surfaces #	2	1	2
e	Construction/repair	2	-	3
f	Thermal efficiency	3	-	2
# Secondary hazards		**A**	**B**	**C**
i	Concrete kerb	2	-	-
ii	Projecting radiator	-	2	-
iii	Glass in front door	-	1	-
iv	Condition of paths	3	-	2

Key			
3	Seriously defective	1	Not satisfactory
2	Defective	-	Satisfactory/NA

COMPLETION OF SECTION 23 OF EHCS FORM

LIKELIHOOD

Falls on stairs

Worse than average (Y) N

Likelihood of a person over 60 having a fall

1800	1000	560	320 (Average)	180 (Pre 1919)	100	56	32	18	<10

Justification The main stairs are assessed as giving the same likelihood of a major fall as the average for inter-war houses, (i.e. around 1 in 320), the limited handrail provision cancelling out any benefits of the broad winders. However, the added presence of the front access steps - particularly dangerous in icy weather and at night - substantially increases the overall annual probability of such a fall - to 1 in 18.

OUTCOMES

Likely outcome if a person over 60 should fall

	0.1	0.2	0.5	1	2.2	4.6	10	21.5	31.6	46.4	100
Class 1 Extreme %						(4.6)					
Class 2 Severe %							(10)				
Class 3 Serious %								(21.5)			

Justification The stairs are designed to be carpeted but the resulting lower harms are offset by the small hall, projecting radiator and single glazing in the door, albeit this is not at low level. However, the presence of the external front door steps and steps near the front gate, both flanked by rough tarmac and a concrete kerb, significantly increase the risk of a fatal or severe fall occuring, particularly in cold weather or at night.

Look-up table

Likelihood Class 1 Outcome	1 in 1800	1 in 1000	1 in 560	1 in 320	1 in 180	1 in 100	1 in 56	1 in 32	1 in 18	1 in 10 or less
0.1%						E-	E	D	C	B
0.2%						E-	E	D	C	B
0.5%						E	E	D	C	B
1.0%						E	D-	D	C	A-
2.2%				F	E-	E	D	C	B	A
4.6%				E-	E	D	C	B-	(B)	A
10.0%			E-	E	D	C	B-	B	A	A
21.5%		E	E	E	C	B	B	A	A	A
31.6%		E	D	C	C	B	A	A	A	A
46.4%	E	E	D	C	B	B	A	A	A	A
100%	D	C-	C	B	A	A	A	A	A	A

ACTION REQUIRED

Justification Replacing the steps to the front door and at the gate will be picked up under Section 18. This will bring the property's rating back to average for its age and type.

Action required to remove hazard

Action required ?	Action	Described elsewhere?	Quantity
Y	Install handrail	Y N	Metres:
Y	Install balustrade	Y N	Metres:
Y	Cover dangerous balustrade/guarding	Y N	Metres:
Y	Repair/replace internal staircase (S5)	Y	
Y	Redesign staircase (design, not condition)	Y N	Number:
Y	Repair/replace external/common staircase (S9)	Y	
Y	Repair/replace external steps (S18)	(Y)	
Y	Cover slippery stairs	Y N	Flights:
Y	Repair/replace/provide additional lighting (S5, S9)	Y N	Number:
Y	Remove obstacle	Y N	Number:

Annex Table 5.5.5: Summary of how EHS collects and models information about HHSRS hazards

Hazard	How assessed	Average HHSRS score	Specified vulnerable age group
Excess cold*	Modelled	926	Age 65 or over
Falling on level surfaces*	Fully measured	181	Age 60 or over
Falling on stairs etc*	Fully measured	134	Age 60 or over
Radiation*	Modelled	91	None
Collision and entrapment	Flagged if an extreme risk	57	Age under 5
Flames, hot surfaces etc*	Fully measured	42	Age under 5
Crowding and space*	Modelled	19	None
Fire*	Fully measured	17	Age 60 or over
Dampness and mould growth*	Fully measured	11	Age under 14
Entry by intruders	Flagged if an extreme risk	11	None
Falls associated with baths	Flagged if an extreme risk	7	Age 60 or over
Noise*	Flagged if an extreme risk	6	None
Falling between levels*	Fully measured	4	Age under 5
Food safety	Flagged if an extreme risk	2	None
Electrical safety*	Flagged if an extreme risk	2	Age under 5
Carbon monoxide and fuel combustion products*	Flagged if an extreme risk	1	Age 65 or over
Personal hygiene, sanitation and drainage*.	Flagged if an extreme risk	1	Age under 5
Explosions	Flagged if an extreme risk	1	None
Position and operability of amenities etc	Flagged if an extreme risk	1	Age 60 or over
Structural collapse and falling elements	Flagged if an extreme risk	1	None
Excess heat	Flagged if an extreme risk	0	Age 65 or over
Asbestos (and MMF)	Not assessed	0	None
Biocides	Not assessed	0	None
Lead*	Modelled	0	Age under 3
Uncombusted fuel gas	Flagged if an extreme risk	0	None
Volatile organic compounds	Not assessed	0	None
Lighting	Flagged if an extreme risk	0	None
Domestic hygiene pests and refuse.*	Flagged if an extreme risk	0	None
Water supply	Flagged if an extreme risk	0	None

Notes:

1) average scores are for all dwellings and taken from Version 2 of the HHSRS guidance. The averages have been calculated for the age range of the population most vulnerable to each type of hazard.

2) the 15 hazards which were scored or modelled for 2006 and 2007 are identified by an asterisk. This group is still used in the current reporting of the 'Decent Homes' HHSRS criterion.

5.99 In the 2006 and 2007 English House Condition Survey (EHCS), fewer hazards were fully scored and some of the hazards that are now measured or flagged were modelled using other data (see the EHCS technical report from 2007 for full details: http://webarchive.nationalarchives.gov.uk/20120919132719/http://www.communities.gov.uk/documents/housing/pdf/1617931.pdf).

5.100 From 2008, reporting of HHSRS covers all of the 26 hazards covered by EHS so figures are not strictly comparable with the 2006 and 2007 HHSRS data.

Reporting on decent homes (see decent homes section later in this note), continues to use the 'old' (15 hazards) version of HHSRS for continuity over time.

5.101 Annex Table 5.5.6 summarises the assumptions and data used for the 4 hazards that are modelled from other data.

Annex Table 5.5.6: Modelling HHSRS hazards using EHS data

Hazard	Category 1 hazard defined as:
Excess Cold	The methodology for modelling excess cold was changed in 2010 following changes to the Standard Assessment Procedure[6] (SAP) methodology (from SAP05 to SAP09). Under the SAP05 methodology a 'threshold value' of 31.49 (equivalent to SAP 35 under the 2001 methodology) was calculated and all dwellings with a rating less than this were categorised as posing a Category 1 excess cold hazard. This SAP01 threshold was originally based on modelling carried out by BRE based on the likelihood of a retired household on means-tested benefits being in fuel poverty. A specific value of SAP05 does not equate to a specific value of SAP09, so an 'equivalent' value of SAP09 was derived (35.79) that ensured that the number and % of dwellings failing on excess cold would be the same under both the SAP05 and SAP09 methodology for the 2010 data set.
Radiation	The dwelling is located in one of the critical 16 post code sectors, based on a radon exposure map of England AND the dwelling was built before 1980.
Lead	The dwelling is located in one of 4 post codes with very soft water (based on the drinking water quality map of England) AND built before 1945 AND with lead piping present either before or after the mains stop cock.
Crowding and space	The occupants per habitable room ratio is calculated. If this exceeds 2 the dwelling has a category 1 hazard regardless of size. If it is equal to 2 and the number of habitable rooms is 2 or more the dwelling also has category 1 hazard.

Data quality and reliability

5.102 Surveyors working on the EHS have received extensive training and support to help ensure their HHSRS assessments are consistent and robust. This includes residential training involving classroom and field exercises together with e-learning exercises. Refresher programmes are provided annually, together with manuals providing benchmark examples for reference when

[6] This is the Government's standard procedure for Energy Rating of dwellings.

making their judgements. New surveyors are accompanied in the field and there is on-going close supervision throughout fieldwork. Calibration exercises are being implemented to monitor variability in surveyors' HHSRS assessments over time.

5.103 While these measures ensure a good level of consistency in judgements, some surveyor variability is to be expected. The EHS approach to the HHSRS provides surveyors with a systematic approach with which to make these judgements.

Decent homes

5.104 This section gives a detailed definition of the four criteria that a dwelling is required to meet to be considered 'decent' under the Decent Homes Standard, and explains how they are applied to the EHS data. A dwelling must meet all of the four criteria listed below to be classed as decent:

A) it meets the current statutory minimum standard for housing

B) it is in a reasonable state of repair

C) it provides reasonably modern facilities and services

D) it provides a reasonable degree of thermal comfort

Criterion A: the dwelling meets the current statutory minimum standard for housing

5.105 The current statutory minimum standard for housing is the HHSRS. To be decent, the dwelling must be free from Category 1 hazards (see previous section).

5.106 The presence of Category 1 hazards is assessed as described in the previous section. For this criterion only the 15 hazards which have been assessed since 2006 are included to ensure consistency over time.

Criterion B: the dwelling is in a reasonable state of repair

5.107 A dwelling satisfies this criterion unless:

- one or more key building components are old and, because of their condition, need replacing or major repair; or
- two or more other building components are old and, because of their condition, need replacement or major repair.

5.108 Key building components are those which, if in poor condition, could have an immediate impact on the integrity of the building and cause further deterioration in other components. They are the external components plus internal components that have potential safety implications and include:

- external walls
- roof structure and covering

- windows/doors
- chimneys
- central heating boilers
- electrics

5.109 If any of these components are old, and need replacing or require immediate major repair, then the dwelling is not in a reasonable state of repair.

5.110 Other building components are those that have a less immediate impact on the integrity of the dwelling. Their combined effect is therefore considered, with a dwelling not in a reasonable state of repair if 2 or more are old and need replacing or require immediate major repair.

5.111 The terms ‘old’ and ‘in poor condition’ are also quite tightly defined as below:

- **old**: the component is older than its expected or standard lifetime. The component lifetimes are listed in Annex Table 5.5.7
- **in poor condition**: the component needs major work, either full replacement or major repair. The definitions used for different components are as listed in Annex Table 5.5.8

5.112 Establishing whether dwellings surveyed in the EHS meet this criterion depends on the assessment both of the ages of key and other building components and of their condition.

5.113 The EHS surveyors record their assessment of the ages of the main external building elements together with key services and amenities. They are also given the shortcut option of recording whether elements are original i.e. the same as the building itself. Where the age of a component cannot be assessed, it is assumed to be original i.e. the same age as the dwelling. In the relatively small proportion of cases where components are recorded as the 'same age as dwelling', it is necessary to calculate the probability that they have exceeded their lifetime. This is because age of dwelling is recorded in relatively wide bands rather than as a single year.

5.114 For example, windows in houses are assumed to have exceeded their lifetime if they are more than 40 years old. Where dwellings were built between 1965 and 1974 and still had the original windows, many of these would have windows that were over 40 years old. A simple and robust approach is used, assuming that roughly equal numbers of dwellings were built in each year of this age band. Dwellings built between 1965 and 1971 (are over 40 years old and) represent 7 years out of the 10 year age band, so all original windows in dwellings built in 1965-1974 are given a probability of 0.7 of being over 40 years old.

5.115 For most dwellings, the assessment of whether or not they satisfy the disrepair criterion is clear cut. For the remainder, for each building component which is in poor condition, the probabilities of being beyond the normal lifetime are combined to give a total probability, taking into account the split into major

and minor elements. If this total is greater than 0.5, the dwelling is classed as non-decent due to disrepair.

5.116 Annex Table 5.5.7 shows the lifetimes of building components used to assess whether the components are 'old' in the terms of the disrepair criterion. These lifetimes are used to construct the national estimates of the number of dwellings that are decent and those that fail.

Annex Table 5.5.7: Component lifetimes used in the disrepair criterion

Building components (key components marked *)	Houses and bungalows	All flats in blocks of below 6 storeys	All flats in blocks of 6 or more storeys
Wall structure*	80	80	80
Lintels*	60	60	60
Brickwork (spalling)*	30	30	30
Wall finish*	60	60	30
Roof structure *	50	30	30
Roof finish *	50	30	30
Chimney *	50	50	N/A
Windows *	40	30	30
External doors *	40	30	30
Kitchen	30	30	30
Bathrooms	40	40	40
Heating – central heating gas boiler *	15	15	15
Heating – central heating distribution system	40	40	40
Heating – other	30	30	30
Electrical system *	modern	modern	modern

5.117 As age of electrical system is not collected in the EHS, it is considered to be 'old' if it is not modern, i.e. it has lead or rubber covered wiring, there are separate fuse boxes for each circuit, or earthing wires are unsheathed/green covered.

5.118 Annex Table 5.5.8 sets out the definitions used within the disrepair criterion to identify whether building components are 'in poor condition'. For more detailed information on how surveyors are instructed to record disrepair, see the repair costs section of this note.

Annex Table 5.5.8: definition of 'poor condition' used in disrepair criterion

	Definition of 'in poor condition' used in EHCS
Wall structure	Replace 10% or more, or repair 30% or more
Wall finish	Replace/ repoint/ renew 50% or more
Chimneys	1 chimney needing partial rebuilding or more
Roof structure	Replace 10% or more or strengthen 30% or more
Roof covering	Replace or isolated repairs to 50% or more
Windows	Replace at least one window or repair/ replace sash or member to at least two (excluding easing sashes, reglazing, painting)
External doors	Replace at least one
Kitchen	Major repair or replace 3 or more items out of 6 (cold water drinking supply, hot water, sink, cooking provision, cupboards, worktop)
Bathroom	Major repair or replace 2 or more items (bath, wash hand basin, WC)
Electrical system	Replace or major repair to system
Central heating boiler	Replace or major repair
Central heating distribution	Replace or major repair
Storage heaters	Replace or major repair

Criterion C: The dwelling has reasonably modern facilities and services

5.119 A dwelling is considered not to meet this criterion if it lacks three or more of the following facilities:

- a kitchen which is 20 years old or less
- a kitchen with adequate space and layout
- a bathroom which is 30 years old or less
- an appropriately located bathroom and WC
- adequate noise insulation
- adequate size and layout of common entrance areas for blocks of flats

5.120 The ages used to define the 'modern' kitchen and bathroom are lower than those for the disrepair criterion. This is to take account of the modernity of kitchens and bathrooms, as well as their functionality and condition.

5.121 There is some flexibility inherent in this criterion, in that a dwelling has to fail on three of these tests to be regarded as failing the modernisation criterion itself. Such a dwelling does not have to be fully modernised for this criterion to be passed: it would be sufficient in many cases to deal with only one or two of the facilities that are contributing to the failure.

5.122 The two tests for age of bathroom and kitchen are relatively straightforward to apply using EHS data. The method of assigning age probabilities described above is also used to determine whether kitchens and bathrooms have exceeded their lifetimes as specified in the modernisation criterion. The probabilities of being non-decent on these two components are added to results on the other modernisation measures in order to determine whether the dwelling should be classed as non-decent.

5.123 There is some ambiguity inherent in terms such as ‘adequate’ and ‘appropriate’ used for the other four criteria. The EHS (and its predecessor the EHCS) defines these operationally as follows:

- a kitchen failing on adequate space and layout would be one that was too small to contain all the required items (sink, cupboards, cooker space, worktops etc) appropriate to the size of the dwelling.
- an inappropriately located bathroom or WC is one where the main bathroom or WC is located in a bedroom or accessed through a bedroom (unless the bedroom is not used or the dwelling is for a single person). A dwelling would also fail if the main WC is external or located on a different floor to the nearest wash hand basin, or if a WC without a wash hand basin opens on to a kitchen in an inappropriate area, for example next to the food preparation area.
- inadequate insulation from external airborne noise would occur where there are problems with traffic (rail, road or aeroplanes) noise. Reasonable insulation from these problems should be ensured through installation of double glazing.
- inadequate size and layout of common entrance areas for blocks of flats would occur where there is insufficient room to manoeuvre easily, for example where there are narrow access ways with awkward corners and turnings, steep staircases, inadequate landings, absence of handrails, low headroom etc.

Criterion D: the dwelling provides a reasonable degree of thermal comfort

5.124 The definition requires a dwelling to have both efficient heating and effective insulation.

5.125 Both of these are defined very precisely in terms of what is present rather than by the overall energy performance of the dwelling.

5.126 Under this definition, efficient heating is defined as any gas or oil programmable central heating or electric storage heaters / programmable solid fuel, or communal heating or LPG central heating or similarly efficient heating systems. Heating sources which provide less energy efficient options do not meet this criterion.

5.127 Because of the differences in efficiency between gas/oil heating systems and the other heating systems listed, the level of insulation that is appropriate also differs:

- for dwellings with gas/oil programmable heating, cavity wall insulation (if there are cavity walls that can be insulated effectively) or at least 50mm loft insulation (if there is loft space) is an effective package of insulation.
- for dwellings heated by electric storage heaters / programmable solid fuel or LPG central heating a higher specification of insulation is required to meet the same standard: at least 200mm of loft insulation (if there is a loft)

and cavity wall insulation (if there are cavity walls that can be insulated effectively).

5.128 Assessing whether the EHS sample dwellings pass or fail the decent homes thermal comfort criterion is complex because it involves an array of survey information related to insulation, heating and structural properties. The data collected on the form and the modelling assumptions have been changed and refined since the original 'baseline' figures were published in 2001. For more information on how these changed from 2001 to 2007 see the EHCS 2007 Technical Report: http://webarchive.nationalarchives.gov.uk/20120919132719/www.communities.gov.uk/publications/housing/ehcstechnicalreport2007.

5.129 The 2008 data experienced modelling changes in the assumptions on cavity wall insulation to incorporate the use of the summary section on cavity wall insulation newly collected on the EHS 2008 physical survey form. There were no modelling changes in 2009.

5.130 The key modelling and form changes affecting thermal comfort since 2010 are:

- where no loft insulation information is available for a room in the roof or a flat roof, appendix S of the SAP 2009 information booklet is used in conjunction with the actual date of construction or, if it is a loft conversion, the date of the loft conversion to determine an estimated amount of loft insulation (the banded construction date is used if the actual construction date is unknown).
- changes in assumptions on cavity wall insulation to incorporate extended use of the summary section on cavity wall insulation collected on the EHS physical survey form following a wording change to the overarching cavity wall insulation summary question.
- homes built after 2002 with cavity walls are assumed to have full cavity wall insulation.

Repair costs

5.131 This section presents an overview of how repair costs are derived from the EHS and is divided into three sections:

- the different repair cost measures used
- what types of work are excluded and included
- an outline of how the raw data is used to generate the costs

5.132 Information about repair costs is used for two basic purposes:

- to assess how much it would cost to carry out the specified work to the dwelling to give some idea of the likely level of investment needed. This is termed 'required expenditure' or 'actual costs'.

- to assess whether parts of the stock are in a better or worse state of repair than others. This is measured through ‘standardised costs’.

5.133 **Required expenditure:** an estimate of what the specified work to the individual dwelling would actually cost. These costs therefore take account of variations in prices across the country and assume different project sizes for work to dwellings, depending on their type and tenure. In the owner occupied and private rented sector, the contract size for work to houses is taken to be one. In the social rented sector, the contract size is taken as the number of dwellings on the estate unless the house is not on an estate and therefore assumed to be a street property with a contract size of one. For flats, the contract size for exterior works is the size of the block regardless of tenure. This measure assumes that all work is carried out by contractors who operate in accordance with health and safety regulations. The costs do not include any VAT or mark up for profit. These costs should not be used for assessing differences in condition between different tenures or dwelling types because they vary according to dwelling size, tenure and location (note: on the EHS database these costs are shown as ‘actual costs’). When making such comparisons among different dwelling characteristics, it would be more appropriate to use ‘standardised repair costs’ as explained below.

5.134 **Standardised repair costs:** an index of disrepair that expresses costs in pounds per square metre (£/m2) based on prices for a mid point in the range of prices in England). The same assumptions about contract size are made for houses in all tenures (contract size = 5 dwellings) and are then divided by the total floor area of the dwelling. The resulting index can be used to compare the relative levels of disrepair for dwellings of different sizes, in different tenures and different locations.

5.135 The extent of work required to a dwelling depends on the judgements made by the surveyor about the urgency of that work. The two different measures of required expenditure and standardised costs are therefore presented with reference to three different time scales:

- **urgent repairs:** a measure of serious and immediate problems in the dwelling, and includes all interior work. Where surveyors record that work is needed to an exterior building element, they indicate whether work specified was urgent. To be classed as ‘urgent’, the ***problem must meet at least one of the following criteria:***
    - o it threatens the immediate safety of occupants or passers-by or is a health hazard
    - o it is currently promoting noticeable and rapid deterioration in other parts of the building
    - o it is at present causing difficulty or discomfort to the occupants (or would do so if the dwelling were occupied)
    - o the security of the building is threatened

    (*variables on database = cstactux and cststdux*)

- **basic repairs:** all works that the surveyor has identified as necessary to carry out within five years, including any urgent work as described above. These do not include replacement of building elements nearing the end of their life where the surveyor has recorded that this action could be delayed by more than five years; often by short term patch repairs. (variables on data base= cstactbx and cststdbx)
- **comprehensive repairs:** all repairs as specified above together with any replacements that the surveyor has assessed as being needed in the next 10 years. For all exterior elements, whether repairs are needed or not, surveyors record the number of years before the element needs replacing either following specified repair work or simply as the remaining life expectancy. This measure provides a better basis for identifying work which would form part of a planned programme of repair by landlords. (variables on data base = cstactcx and cststdcx)

What types of work are included and excluded?

5.136 The costs described above include all of the following types of work:

- all work to the external fabric of the building - chimneys, roof, roof and soil drainage, windows, doors, dormers, bays, porches, balconies, damp proof course and treatment of inappropriate gradients/levels of ground adjacent to the dwelling
- additional work to deal with structural instability: e.g. underpinning, tying in of walls, treatment of fungal or insect infestation, replacement of cavity wall ties, etc
- work to the internal fabric - ceilings, floors, internal and partition wall surfaces, internal doors and stairs
- work to amenities and services inside the dwelling - kitchen, bathroom, WC, electrical wiring, plumbing, gas pipes, heating, and water heating
- work to common areas and access ways in blocks of flats - floors, walls, ceilings, doors, screens, windows, lighting and balustrades
- work to shared facilities on estates - stores and common rooms, communal parking facilities, surfaces and fences and common services. Note that this only covers any shared facilities that might be used by the occupants of the survey dwelling and which, for large estates, are located within 100 metres of the survey module.

5.137 The costs **exclude**:

- work to fences and boundary walls
- work to underground drainage
- hidden work to structure or foundations
- work to plant associated with shared facilities, e.g. lift motors, communal boilers, washing machines in laundry rooms, etc.

- shared facilities not used/useable by the dwelling itself
- VAT, professional fees, overheads or profit.

5.138 It is also important to remember that repair costs are based on a snapshot of the housing stock at the time of the survey and no provision is made for any routine regular maintenance that would (or should) be carried out e.g. servicing of boilers, lifts etc. or clearing of gutters.

Calculating repair costs

5.139 The EHS uses 4 types of information to calculate base repair costs:

- The surveyors' assessments of the type of repair needed and its extent
- The surveyor's description of the materials from which the element is constructed (for external elements only)
- Building dimensions and configuration derived from surveyors' measurements and observations
- Unit prices for different types of job from the 1996 National Schedule of Rates (NSR), adjusted for inflation using the Building Cost Information Service (BCIS) national price index. The BCIS data is used to convert basic standardised repair costs (£/m²) to 2001 prices so that the level of disrepair over time can be examined. This rebasing to 2001 prices is undertaken for ease of analysis for each annual EHS report, so that only the current EHS data requires rebasing for the on-going time series analysis

5.140 The surveyor assesses each element in turn; usually surveying the interior first, and then the exterior of the dwelling. Internally an assessment of the main rooms is made (the main living room, main bedroom plus hall, kitchen and bathroom. The work identified as needed in the sample of rooms is scaled up to reflect the total number of rooms in the dwelling. All of the internal amenities and services are surveyed individually.

5.141 For the common areas in blocks of flats, surveyors select only part of the common areas to survey – the main entrance, stairway and corridor/deck used by the survey dwelling. These are assumed to be representative of the whole of the common areas and scaled up accordingly.

5.142 Externally the surveyor assesses each element in turn, looking at the building from two vantage points ('views') which between them encompass the whole building.

5.143 In assessing the type and extent of work needed, surveyors follow a sequence of decisions that are made explicit on the survey form:

- identify whether there is a fault
- determine the nature of the action
- determine the scale of the action

- determine the timing of the action (for exterior elements only)

5.144 These assessments will depend on a large number of factors. What standard of repair should be aimed for? Will the work be spread over time or is it all to be done straightaway? How long must the building remain in good condition once the work is done? How much is it worth spending on the building? According to how these questions are answered, the final repair cost can vary considerably. EHS therefore sets fairly stringent ground rules and assumptions for surveyors to follow.

5.145 In making their assessments, surveyors are instructed to assume that dwellings have an indefinite life – repairs are recorded even where it is felt to be uneconomic.

5.146 When determining the nature of the action required, they are instructed to treat the work as a programme of actions stretching into the future which means to repair rather than replace unless:

- this is impracticable
- it means that the element will still need replacing within 5 years
- the element needs replacing for other reasons, e.g. it is unsuitable for its intended purpose. Here, the standard of work should result in the element being fully functional without any allowance for modernisation, upgrading or purely cosmetic improvements.

5.147 In deciding how much of the element requires the specified action, they are instructed not to employ economies of scale. The quantity of work required is recorded in different ways for different types of elements:

- in tenths, for elements treated as areas, e.g. walls, roofs, or lengths e.g. roof features. The building measurements and other information enable us to calculate the total number of square metres of each element in each view or room e.g. external walling at the rear, ceiling in the kitchen etc. and these are then multiplied by the proportions indicated by the surveyor to obtain an actual quantity
- in number of units needing work, for elements which can be treated as individual entities, e.g. doors, windows, baths
- in square or linear metres for work to elements where there is insufficient data to estimate the total quantity within the building e.g. flooring in common areas

5.148 For the last two, the quantity given is multiplied by the unit cost for the job specified. For elements where the work is specified as a proportion, this is first converted to a quantity (m2 or linear metres) from the dimensions taken of the dwelling/building and then this quantity is multiplied by the unit price (per m2 or per m) for the type of work specified. In all cases it is assumed that a like for like replacement is undertaken and the costs selected reflect the materials

from which the element is currently constructed, e.g. a slate roof is always replaced with a slate roof.

5.149 The cost calculated is for the individual dwelling. Therefore for flats the cost of works to the common areas and exterior, recorded for the whole building, is divided by the number of flats and this is added on to the interior, amenities and services costs for the individual dwelling.

Dealing with missing data

5.150 The cases included in the physical survey database are those where a full survey was conducted, but even where the form was completed fully the surveyor may have omitted to provide some information needed to calculate repair costs. Such omissions are, however, increasingly rare, particularly after the introduction of the digital pen technology.

5.151 Where data is missing costs are imputed using data for dwellings of a similar age and type:

- if the surveyor has clearly indicated that repairs are needed to an element, but not what those repairs are, then an average cost for that element is taken from dwellings of a similar age and type where repairs are needed to that same element.
- if the surveyor has not indicated whether repairs are needed to an element, then an average cost for that element is taken from all dwellings of a similar age and type.

Add-ons, uplifts, preliminaries and modifications to base costs

5.152 Once the ‘base’ costs have been calculated as above, additional sums are added to account for preliminaries and access equipment:

- preliminaries: items required before the work can commence e.g. site hut, security fencing
- access equipment: includes the costs for scaffolding, cradles and other equipment needed to work safely at height.

5.153 There are also factors added to account for ‘uplifts’ or economies of scale which are calculated differently for the ‘required expenditure’ and ‘standardised costs’ versions as described above. Finally, the country is divided into nine continuous geographic areas possessing a broad level of cultural homogeneity each of which is assigned a separate price factor to represent the differing costs of labour and materials in that area. These price factors are then are used to further refine the ‘required expenditure’ costs.

5.154 It is important to remember that costs do not include any VAT, professional fees, overheads or profit.

Annex 5.6: Energy Efficiency

5.155 The English Housing Survey (EHS) collects a large amount of detailed information relating to building construction, heating and insulation. This provides a detailed profile of the energy performance and carbon emissions of the existing housing stock and how far these could be improved using different types of measures. This note sets out how the individual components that contribute to overall efficiency are defined and modelled; the methods and assumptions used to calculate SAP (energy efficiency) ratings and carbon dioxide emissions; and how an assessment is made of what measures could be installed to improve energy efficiency and reduce carbon emissions and what the impact of installing these possible improvements would be.

Heating systems

5.156 The EHS records up to two forms of space heating system and all water heating systems present in each dwelling. Where two types of space heating system are present, the EHS designates the one that covers the largest proportion of the dwelling as the primary heating system and collects detailed information on its overall type, the fuel used, boiler details (where relevant) and heating controls. The primary space heating type is classified as follows:

- ***central heating system:*** this is most commonly a system with a gas fired boiler and radiators, distributing heat throughout the dwelling. Also included in this definition are warm air systems, communal heating and electric ceiling/under floor heating, (included in 'other systems' in the 2012 dataset). Central heating is generally considered to be a cost effective and relatively efficient method of heating a dwelling, although the cost effectiveness and level of carbon dioxide (CO_2) emissions will be closely linked to the type of fuel.
- **storage heaters:** these are predominately used in dwellings that have an off-peak electricity tariff. Storage heaters use off-peak electricity to store heat in clay bricks or a ceramic material; this heat is then released throughout the day. These are more cost effective than fixed or portable room heaters, but storage heating can prove expensive if too much on peak electricity is used during the day.
- **room heaters:** this category includes all other types of heater such as fixed electric or portable electric heaters. This type of heating is generally considered to be the least cost effective of the main systems and produces more CO2 emissions per kWh.

5.157 Where the heating system has a boiler, the EHS also collects basic information on its generic type:

- **standard:** these provide hot water or warm air for space heating; with the former also providing hot water via a separate storage cylinder.
- **back:** these older models are located behind room heaters and feed hot water to a separate storage cylinder. They are generally less efficient than other boiler types.

- **combination:** provides hot water or warm air for space heating and can provide hot water on demand, thus negating the need for a storage cylinder and therefore requiring less room.
- **condensing:** standard and combination boilers can also be condensing. A condensing boiler uses a larger, or dual, heat exchanger to obtain more heat from burning fuel than an ordinary boiler, and is generally the most efficient boiler type. Recent changes to Building Regulations have seen an increase in condensing boilers as they have become mandatory for all replacements.

5.158 The EHS also collects information about the make and model of the boiler and its age so that an accurate estimate of its overall fuel efficiency can be derived. For storage heater systems, their efficiency is calculated based on their age and the type of controls present.

5.159 Where more than one space heating system or appliance has been recorded and the primary system identified as above, the additional appliance is coded as the secondary system and, along with the secondary fuel, used in the SAP calculation and other analysis.

5.160 Where more than one space heating system is present, all existing water heating systems are recorded with the most efficient being selected for analysis. The categories of water heating systems used in the report are:

- ***with central heating:*** the water is primarily heated by the same system as the primary space heating, usually a standard boiler with a separate storage cylinder or a combination boiler heating water on demand.
- ***dedicated water boiler:*** a separate boiler to the space heating system, possibly using a different fuel, provides the hot water.
- ***immersion heater:*** hot water is provided by a single or dual electric immersion heater in the storage cylinder. These are less energy efficient than central or separate boilers, but are often found as a 'top-up' system for other systems.
- ***instantaneous water heater:*** the least energy efficient water heating appliances heat small amounts of water on demand in a similar way to a kettle and distribute the hot water to one or more points.

Wall types and wall insulation

5.161 The construction of the external walls and whether they contain any additional insulation is an important determinant of heat loss. The EHS collects detailed information on the overall construction type, age of the building, added wall insulation and what proportion of the external walls consists of different types, which is used to determine whether the dwelling is classed as having cavity walls and whether the walls (cavity or other) have any added insulation. A cavity wall is one constructed of two brick or block walls separated by a cavity that is at least 50mm wide. They are generally found in houses dating from about 1930 onwards, although some older examples exist. Many dwellings (especially older private sector homes) have a mix of wall types because they

have had one or more extensions added at different times. Dwellings are only classed as 'cavity wall' where at least 50% of the total external wall area is cavity brickwork. This means that a small house built with solid 9" brick walls in 1900 which had a cavity brickwork extension that was larger than the original building added in 1960 would be classed as having 'cavity walls'.

5.162 Dwellings with cavity walls can have none, part or all of the cavity wall area insulated. The insulation can be built into the original wall construction or installed later and can reduce fuel costs by up to 15%.

5.163 In addition to cases which have been identified as cavity insulated and cavity uninsulated, annual EHS reports since 2010 have used a third category for post-1990 dwellings with predominantly cavity walls but no evidence of cavity wall insulation. It is likely that these dwellings had insulation installed when built, but this can not necessarily be assumed since the 1990 and 1994 Building Regulations both specify an external wall U-value which could be achieved through other mechanisms as an alternative to cavity fill. Further, in the 1994 Building Regulations the 'Target U-value' method was introduced as an alternative method of showing compliance. The requirement would be met if the calculated average U-value of the dwelling did not exceed the Target U-value, corrected for the proposed method of heating. This allowed a greater flexibility in selecting the insulation levels of individual elements in the building envelope. For example, 1994 Building Regulations specify an external wall U-value of 0.45 W/m2/K. Using the Target U-value approach in the 1994 Building Regulations meant that the external wall U-values could be greater than 0.45 W/m2/K but to compensate the U-values of the other external elements had to reduce below the specified U-values, or as the Target U-value approach was based upon a central heating system of 72%, installation of a more efficient heating system meant that the specified insulation levels in the Building Regulations could be relaxed[7].

5.164 Where dwellings do not have cavity walls, external or internal wall insulation can be installed to improve energy efficiency where the thermal properties of the external walls are poor. Where a surveyor has recorded that external wall insulation had been applied to at least 50% of a non-cavity walled dwelling, or that at least 50% of the measured rooms have had internal insulation applied, it was classed as having an insulated solid wall.

Loft insulation

5.165 Adequate loft insulation can make significant savings to both heating costs and CO2 emissions, making this a cost effective method of insulation. It involves fitting insulating foam or fibre between the joists or rafters in a loft, which prevents the rising heated air from escaping through the roof.

5.166 The EHS physical survey involves an inspection of the loft where the surveyor notes whether insulation is present and measures its thickness. The collection of loft insulation data was changed after the 2001 English House Condition

[7] For examples of the Target U-value methodology see Appendix F of the 1994 Building Regulations Part L1 A - http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADL_1995.pdf

Survey (EHCS), so analysis of data from 2003 onwards can not be directly compared to previous data (see the EHCS 2003 technical report for details). In cases where surveyors are unable to access lofts or where the dwelling is a house or top-floor flat with a flat or shallow pitched roof, the amount of insulation in the dwelling was classed as unknown in the 2012 Energy Efficiency of English Housing Report. However for the purpose of calculating a SAP rating, an amount was assigned using the mean value for dwellings of that age, tenure and broad geographical area. These classifications were used because earlier regression analysis indicated that these factors were the main determinants of the amount of loft insulation present.

Low energy lighting and conservatories

5.167 Analysis in the 2011 Homes Report examined headline figures for homes which predominantly use low energy lighting and those with conservatories. This used the interior section to calculate the proportion of surveyed rooms with low energy lights at the time of survey, whist data relating to the size, glazing type and heating of conservatories was also taken from the raw physical survey data. This data has not been re-analysed in the 2012 Energy Efficiency of English Housing Report as the conclusions were very similar to 2011, but these areas may be re-visited in future.

Renewable measures

5.168 Since 2009, EHS surveyors have recorded the presence of solar photovoltaic panels and domestic wind turbines for electricity generation, whilst the presence of solar hot water panels has been collected since 2001. The 2011 Homes Report and 2012 Energy Efficiency of English Housing Report included analysis of any observed renewable energy technologies.

5.169 In the full SAP methodology a calculation is used to determine the electricity production of PV panels, using peak power of the type of PV panel multiplied by factors such as dwelling orientation and overshading. This level of detail is not available from the EHS, so an assumed peak power of 2.5kWh is applied to each case. Starting from the survey year 2014/15 the area of the panels will be collected to improve this assumption.

5.170 A further renewable measure, the potential for upgrading an existing solid fuel boiler to a more energy efficient biomass system is briefly analysed in chapter 1 of the 2012 Energy Efficiency of English Housing Report. This is covered in Annex Table 5.6.2 below.

SAP ratings

5.171 The Standard Assessment Procedure (SAP) is the Government's recommended system for home energy ratings. SAP ratings allow comparisons of energy efficiency between different dwellings to be made. The SAP rating is expressed on a logarithmic scale, which normally runs from 1 (very inefficient) to 100, where 100 represents zero energy cost. The rating can be greater than 100 for dwellings that are net exporters of energy; however these are extremely rare in the existing dwelling stock. In extremely

inefficient cases the formula that defines the rating can result in negative values.

5.172 The Building Regulations require a SAP assessment to be carried out for all new dwellings and conversions. Local authorities, housing associations, and other landlords also use SAP ratings to estimate the energy efficiency of existing housing. The version of SAP used in the survey is currently SAP 2009, which was effective from March 2010 in England and Wales. This version is used in the current EHS dataset (employed retrospectively to provide a consistent measure from 1996 to the most recent survey year), whilst EHS reports dating from 2006 to 2009 used the previous (SAP 2005) version of SAP. Full details of how this differs from the current SAP 2009 can be found on page 5 of the SAP 2009 methodology document: http://www.bre.co.uk/filelibrary/SAP/2009/SAP-2009_9-90.pdf.

5.173 The SAP ratings give a measure of the annual unit energy cost of space and water heating for the dwelling under a set heating regime which assumes specific heating patterns and room temperatures. The fuel prices used are averaged over the previous three years across the different areas of the UK. The SAP rating takes into account a range of factors that contribute to energy efficiency, which include:

- thermal insulation of the building fabric;
- the shape and exposed surfaces of the dwelling;
- materials used for construction of the dwelling;
- efficiency and control of the heating system;
- the fuel used for space and water heating, ventilation and lighting;
- ventilation and solar gain characteristics of the dwelling;
- renewable energy technologies.

5.174 SAP is not affected by the individual characteristics of the household occupying the dwelling, nor by its geographical location. The calculation is based on a fixed heating pattern of 21°C in the main living area and 18°C elsewhere. It is also based on standard occupancy assumptions with the household size correlating with the total floor area of the dwelling.

5.175 The Energy Efficiency Rating (EER) is derived by translating the SAP ratings into an A to G banding system where band A represents low energy costs and band G represents high energy costs. The cut-off points between bands are shown in Annex Table 5.6.1.

Annex Table 5.6.1: SAP rating and Energy Efficiency Rating (EER) bands

SAP rating	EER band
1 to 20	G
21 to 38	F
39 to 54	E
55 to 68	D
69 to 80	C
81 to 91	B
92 or more	A

5.176 The EHS uses a computerised version of the SAP methodology to calculate the SAP rating for each dwelling included in the physical survey sample. Most of the data required to calculate SAP are available from the survey, either directly from the questions asked or as a result of further modelling. Those data items that are not collected have very little impact on the final calculated rating. Where data items are missing these are dealt with using default information based on information from dwellings of the same age, built form, tenure, number of floors and size.

5.177 The effect of using the SAP 2009 methodology in the 2012 and 2012 Energy Efficiency of English Housing Report increased the average SAP rating by around 0.5 SAP points above the value given under the SAP 2005 method. In general, the range of SAP ratings achieved has narrowed slightly, with high and low SAP 2005 values being closer to the average under SAP 2009.

Carbon dioxide emissions

5.178 The carbon dioxide (CO2) emissions are calculated using the same SAP document and method as for the SAP rating except that it uses CO2 emissions factors for each fuel in place of unit prices to derive the CO2 emissions rate per m2 of floor area. The same logarithmic scale as used for SAP converts the CO2 emissions rate into the Environmental Impact Rating (EIR), which also runs on a 1 – 100 scale where 1 represents very high emissions per m2 and 100 is achieved at zero net emissions. The EIR can rise above 100 if the dwelling is a net exporter of energy.

Comparison with actual energy data

5.179 The SAP methodology that is used to calculate both energy efficiency and CO2 emissions tends to provide higher estimates of energy requirements and associated emissions for heating, lighting and ventilating dwellings than estimates derived from actual household energy consumption. This is primarily because the assumed heating regime (achieving a temperature of 21°C in the living area of the dwelling and 18°C in the rest of the dwelling for a standard number of hours), and the assumed hot water and lighting requirements (depending on a level of occupancy determined by the floor

area of the home rather than actual occupancy) are more likely to result in an overall over estimation than under estimation of actual energy consumption for most dwellings. However, such standardised assumptions are necessary in order to compare the energy performance of one part of the housing stock with another and over time.

Energy performance certificate improvement measures

5.180 Following the implementation of the European Energy Performance of Buildings Directive in 2007, all homes are required to have an Energy Performance Certificate (EPC). The EPC provides an overall assessment of the current energy performance of the property and makes recommendations regarding a range of lower and higher cost heating, insulation and lighting upgrades that would improve its energy performance. The EHS is able to provide a whole stock assessment of homes that could benefit from a subset of these measures.

5.181 Details of the upgrade measures recommended on an EPC are provided in Appendix T of the SAP 2009 specification, available at: http://www.bre.co.uk/filelibrary/SAP/2009/SAP-2009_9-90.pdf. These have been reduced to a set of measures that can be assessed using EHS data and are shown in Annex Table 5.6.2.

Annex Table 5.6.2: EPC measures assessed using EHS

EPC low cost measures (under £500)	EPC higher cost measures (more than £500)
Install cavity wall insulation where the wall is of cavity construction	Upgrade central heating controls - typically to a stage where a room thermostat, a central programmer and thermostatic radiator valves (TRV's) have been installed
Install or upgrade loft insulation where there is a loft that is not a full conversion to a habitable room and has 150mm or less of loft insulation	Upgrade to a class A condensing boiler using the same fuel (mains gas, LPG or fuel oil). This is not applied to communal heating systems.
Install or upgrade hot water cylinder insulation to a level matching a 160mm jacket. This is only recommended where the current level is less than 25mm of spray foam or a jacket that is less than 100mm thick.	Upgrade existing storage radiators (or other electric heating) to more modern, fan-assisted storage heaters
	Install a hot water cylinder thermostat where there is a cylinder without a thermostat
	Replace warm-air units that are over 20 years old with a fan-assisted flue
	Install a manual feed biomass boiler or wood pellet stove where the current system uses non-biomass solid fuel.

5.182 In the method used in the EHS, measures are only recommended for implementation if that measure alone would result in the SAP rating increasing by at least 0.95 SAP points. The suggested measures do not necessarily imply that current measures in place in the home are defective nor that the home is deficient in terms of any particular standard.

5.183 The EHS does not include all of the possible EPC measures. This is because some would only be recommended in a small number of dwellings or because the survey is unable to assess how effective they would be in improving the performance of individual dwellings. Annex Table 5.6.3 lists the measures that are not included in the EHS analysis.

Table 5.6.3: EPC measures not covered in EHS modelling of improvement potential

EPC low cost measures (under £500)	EPC higher cost measures
Draught proofing single glazed windows	Solar water heating
Low energy lights	Double or secondary glazing
	Solid wall insulation
	Complete change of heating system to class A condensing boiler (including fuel switching)
	Solar photovoltaic (PV) panels

5.184 The EHS also estimates the notional costs of installing the recommended measures. The costs are applied in the following way for the respective energy efficiency measures:

- Price per unit: Heating controls (room thermostat, programmer), cylinder insulation, cylinder thermostat, boiler upgrade (separate prices for combination/non-combination boilers), biomass boiler upgrade, storage radiator upgrade, warm air heating upgrade;
- Price per habitable room: Heating controls (Thermostatic Radiator Valves);
- Price per m^2: cavity wall insulation, loft insulation.

Post improvement performance and costs

5.185 The EHS also estimates the SAP rating carbon dioxide emissions and fuel costs after any recommended improvements have been installed.

5.186 It is also important to emphasise that these are *notional* estimates based on standard assumptions about occupancy and consumption patterns. What improvements would be realised in practice will depend critically on actual occupancy and consumption patterns.

Barriers to improving insulation

5.187 A chapter in the 2012 Energy Efficiency of English Housing Report examined the potential to install loft, cavity wall and solid wall insulation, and explored the practical and other barriers to actual installation that can occur, in order to

provide a more realistic indication of the potential for carrying out these improvements. Categories classifying the ease of installation or specific barriers for each insulation type were created from EHS physical data on dwelling fabric and shape.

5.188 Categories for the ease of installing or topping up loft insulation were:

- ***non-problematic:*** these were identified as potentially upgradeable under the EPC improvement measure analysis and in these cases installation would be straightforward with no barriers.
- ***hard to treat:***
  - ***more problematic:*** these were identified as potentially upgradeable under the EPC improvement measure analysis but where the loft was fully boarded across the joists, which would lead to extra work and expense.
  - ***room in roof:*** these cases may already have sufficient insulation installed when built or during the loft conversion, but if insulation needed to be added between the rafters very extensive work and considerable expense would be involved.
  - ***flat or shallow pitched roof:*** again, these cases may already have sufficient insulation installed when built but otherwise it is not feasible to install loft insulation as there is no access into the loft or no loft space.

5.189 For the 2012 report, the classification and analysis for the 'fillability' of cavity walls differed from the approach used in the 2010 and 2011 EHS Stock Profile Reports. The new methodology aims, as far as possible, to provide a count of hard to treat cavity walls consistent with the ECO definition, although the EHS is unable to fully replicate this. See https://www.ofgem.gov.uk/ofgem-publications/84197/ecosupplementaryguidanceonhard-treatcavitywallinsulation.pdf

5.190 Categories for the 'fillability' of uninsulated cavity walls were created using information on the area of external wall finish as surveyed and other factors such as the presence of external features such as conservatories and the dwelling type:

- ***standard fillable:*** with these cases, no compelling physical barrier to installation exists. These are typically houses with masonry cavity walls and masonry pointing or rendered finishes and no conservatory attached.
- ***hard to treat cavity walls:*** These are homes with cavity walls that could in theory be filled, but which exhibit one of the following difficulties.
  - They are in a building with 3 or more storeys, where each storey has cavity walls. The need for scaffolding to install insulation in these higher buildings would contribute to the complication and cost of improving these homes.
  - The gap found in the cavity wall is found to be narrower than in standard walls, typically less than 50mm. Although an attempt could be

made to insulate these homes by injecting foam, the limited cavity space may lead to an uneven spread of the insulating material, resulting in substandard thermal properties.

- The dwelling is of predominantly prefabricated concrete, metal or timber frame construction. Although more recent examples of these homes will have had insulation applied during construction, these are generally unsuitable for retrospective treatment. In the case of timber frame construction, the industry recommendation is not to inject insulation as this can hamper ventilation between the frame and the external wall that may lead to rot in the timber frame.
- The cavity wall includes one or both leaves formed of natural stone, or has an outer leaf finished predominantly with tiles or cladding. Natural stone can give an uneven cavity, causing difficulties when injecting insulation, whilst non-masonry finishes can also make the process more difficult.

5.191 Categories for the ease of installing external solid wall insulation were created using information on the area of external wall finish as surveyed and other factors such as the presence of external features such as conservatories, porches and bays and the dwelling type:

- ***non-problematic:*** no serious barriers.
- ***hard to treat:***
  - ***masonry-walled dwellings with attached conservatories or other features:*** these are otherwise non-problematic, but fixing the insulation round any projections like conservatories, porches or bays requires additional work and therefore additional expense.
  - ***dwellings with a predominant rendered finish:*** although dwellings with a rendered finish can be treated with external solid wall insulation, this may add to the costs of the work as the render may need to be removed, repaired or treated before the insulation can be installed.
  - ***dwellings with a predominant non-masonry wall finish:*** improving dwellings with wall finishes such as stone cladding, tile, timber or metal panels would either add to the cost of the work or even preclude external solid wall insulation where the wall structure itself is stone or timber.
  - ***flats:***if the dwelling is a flat, then this treatment can be problematic for two reasons. Firstly, there are likely to be issues related to dealing with multiple leaseholders (getting their agreement and financial contribution to the work). Secondly, the height of the module for high-rise flats would present significant complications in applying external solid wall insulation.

Household awareness of energy performance certificates

5.192 Since October 2008 it has been a requirement for those selling or renting out dwellings to provide the new or potential occupants with an EPC. The 2011 EHS Stock Report, used information collected in the 2011-12 household interview, to explore the impact of the EPC on those households that saw it.

5.193 New 2012-13 interview survey data has not been analysed for the 2012 EHS Energy Performance Report as the conclusions would be very similar to 2011. This area may be re-visited in future EHS reports.

Chapter 6
Weighting

In order to provide accurate and unbiased national estimates, the English Housing Survey (EHS) is weighted to take account of the over-sampling of the less prevalent tenure groups and differential non-response. This chapter provides details of the weighting methodology used and gives advice on which weights to use when conducting analysis using EHS data.

Overview

6.1 The following weights have been calculated for the 2012-13 EHS data:

- aagfh12: Household weight for full sample interview survey 2012-13
- aagpd1112: Average dwelling weight for cases in 2011-12 and 2012-13 that had both the interview and physical survey conducted (paired cases)
- aagph1112: Average household weight for cases in 2011-12 and 2012-13 that had both the interview and physical survey conducted (paired cases)

6.2 These weights adjust the sample to take account of the over-sampling of the less prevalent tenure groups and reduce the bias from differential non-response.

6.3 The weighting of the 2012-13 EHS data was undertaken by NatCen who managed the survey on behalf of the Department for Communities and Local Government (DCLG).

Summary of weighting methodology

6.4 The weighting strategy uses a sequence of fifteen stages described below. Some stages correct for the disproportionate selection when sampling; others for differential non-response in the interview/physical survey response process.

Stages 1 and 2 apply to both the full household sample and the dwelling sample and adjust for:

- Stage 1: Address selection probabilities
- Stage 2: Address to dwelling relationship

Stages 3 to 6 apply to the full household sample and adjust for:

- Stage 3: Dwelling to household relationship
- Stage 4a: Office refusals - refusal to cooperate prior to the interview
- Stage 4b: Non-contact at the interview survey
- Stage 5: Non-cooperation at the interview survey
- Stage 6: Calibration of weighted estimates from the interview survey to known population totals

Stages 7a to 15 apply to the dwelling sample and adjust for:

- Stage 7a: Office refusals – refusal to cooperate prior to contact at the dwelling
- Stage 7b: Non-contact at the dwelling
- Stage 8: Non-cooperation at the dwelling
- Stage 9: Sub-sampling by tenure for the physical survey
- Stage 10: Non-cooperation at the physical survey
- Stage 11: Calibration of weighted estimates to dwelling controls totals, including an adjustment for new builds
- Stage 12: Creation of household weight by calibrating the weighted estimates to the same population totals as the full household sample
- Stage 13: Creation of a household weight using the stage 11 weights and the household to dwelling relationship
- Stage 14: Final household weight by scaling stage 13 weight to produce the same weighted totals as the stage 12 calibrated weight
- Stage 15: Final dwelling weight which is consistent with the final household weight

Stages 1 to 5, 7a to 10 and 13 to 15 are implemented using a set of SPSS syntax scripts in combination with the specialist SPSS module AnswerTree.

Stages 6, 11 and 12 use the calibration command in Stata.

6.5 These processes are described in more detail below.

Adjusting for the relationship between addresses and dwellings

6.6 Stage 1 generates the selection weights for the issued sample of addresses. This has two components: the first is a weight for the address selected for the office sift to the number of PAF; the second corrects for the unequal selection of addresses within each predicted tenure type (within each quarter) from those addresses selected from the PAF for the office sift.

6.7 Subsequent stages involve multiplying these initial weights by successive adjustment factors.

6.8 The EHS analyses are concerned with dwellings and households rather than addresses, and there is not always a one-to-one relationship between an address, a dwelling, and a household. (For the purposes of the survey, a dwelling is defined as 'a self-contained unit of accommodation where the occupants of that accommodation have sole use of all the rooms and facilities').

6.9 Usually there is only one dwelling at each address sampled from the PAF, but addresses are occasionally found to cover more than one dwelling (for example if a house has been converted into self-contained flats) or only part of a dwelling (for example a bedsit which shares facilities with a household at a separate postal address). As only one dwelling is selected at these addresses, weights are required to account of this.

6.10 Where an address refers to more/less than one dwelling, each dwelling at that address would have a lower/higher chance of selection for the EHS. Stage 2 adjusts the weight calculated at Stage 1 to take account of the address to dwelling relationship for such cases. Weighting classes are generated defined by region, tenure and type (house, low rise flat, high rise flat). Within each of these weighting classes, the average number of dwellings per address is calculated to generate the address to dwelling weight.

Weighting the full household sample

6.11 Stage 3 makes an adjustment for the selection of a single household at dwellings that contain more than one household. This weight is calculated using the same approach as the address to dwelling weight (see 6.8), as the average number of households per dwelling within weighting classes defined by region, tenure and type (house, low rise flat, high rise flat).

6.12 Refusal to co-operate prior to interview, non-contact at interview and refusal to co-operate at interview do not happen completely at random and the factors associated with each of these three processes may differ. Stages 4a,

4, and 5 each use available information about each case as predictor variables in a model to partition the sample into groups in order to describe as much variation in the response variable as possible. These models are constructed using the CHAID[1] algorithm in the SPSS AnswerTree software. Typical predictor variables for Stage 4a are geographical area; predominant tenure, dwelling age and dwelling type in the area; urban/rural classification. For subsequent stages, information collected by the interviewer is also used.

6.13 Response weights are calculated for each of the groups produced by AnswerTree at each of Stage 4a, 4 and 5.

6.14 The previous five stages account for the sampling and response probabilities. Applying the weight from Stage 5 to the household-level data would provide a survey estimate of the total number of households in England. However, this will differ from the true value because of sampling error, under-coverage of the frame and inadequacies in capturing the non-response mechanisms. Estimates for subgroups such as tenures will differ from their true values for the same reason. These differences in the survey estimates can be reduced by adjusting (calibrating) the weights so that the total final weights match external control totals.

6.15 The control totals used for Stage 6 were based on ONS population projections by sex and age group by geographical area, and tenure (owner occupied, social sector and private rented sector) from the Labour Force Survey as at 1 October of the survey year.

Weighting the dwelling sample

6.16 The approach to weighting the paired cases which make up the dwelling sample is dwelling-based rather than household-based so, in contrast to the weighting of the full household sample described above, all dwellings identified as vacant at which a physical survey was achieved are included in the sample to be weighted.

6.17 This process is more complex than that for the full household sample, partly because of the need to create internally consistent household and dwelling weights, and also because of the need to combine two years' dwelling sample data to obtain a large enough sample for analysis.

6.18 In outline, the approach is to first weight up the dwellings data for the current year to estimated dwelling controls by tenure based on DCLG published data on dwelling stock, then to adjust this weighting so that the number of weighted households that result from it is consistent, within tenure and geographical area, with the weighted full household sample.

[1] Chi-squared Automatic Interaction Detector

6.19 The weighting process starts by using Stages 1 and 2, described above, to take account of the initial sampling fractions and the address to dwelling relationship.

6.20 Stage 7a then compensates for office refusals at the interview survey stage. This process uses AnswerTree as in Stage 4a but with the inclusion of dwellings identified as vacant.

6.21 Stages 7b and 8 adjust for interviewer contact at the dwelling and for co-operation with the interview survey. All vacant dwellings are deemed to have been 'contacted' provided they have been located by the interviewer, and to have 'cooperated' with the interview survey phase.

6.22 The dwelling sample is required to contain a disproportionate number of rented properties. This is achieved by sub-sampling the issued sample during the interview survey once information about tenure, including tenure of vacant properties, has been collected. Only dwellings selected at this stage are eligible for the physical survey. Sub-sampling rates for the physical survey can also be varied between quarters, as was done for 2011-12. Stage 9 calculates adjustments to the weights to take account of this sub-sampling.

6.23 Stage 10 adjusts for response to the physical survey, within weighting groups created by AnswerTree. For this stage, data collected during the interview survey are also used to help determine the weighting groups; the vacant cases are treated separately.

6.24 As with the interview survey weighting, the initial weighting stages of the physical survey (Stages 1, 2, and 7a - 10) attempt to account for sampling and response probabilities and so the total weight of the data gives a survey estimate of the total number of dwellings in the population. However, this will differ somewhat from the true value because of factors such as sampling error, under-coverage of the frame and inadequacies in capturing the non-response mechanisms. These differences in the survey estimate can be reduced by adjusting (calibrating) the weights to match chosen control totals.

6.25 The control totals used for stage 11 were based on DCLG dwelling estimates by tenure and geographical area, as at 1 October of the survey year. The weights of all cases with a construction date of 1990 onwards were then adjusted (re-calibrated to the same DCLG dwelling estimates) using the number of new dwellings built since the time of sampling, separately for areas with a high/low rate of new build, and private/social sector housing (excluding local authority housing).

6.26 Stage 12 creates a household weight for the paired sample, by calibrating the stage 10 weights to ONS population projections by sex and age group by geographical area, and tenure (owner occupied, social sector and private

rented sector) from the Labour Force Survey as at 1 October of the survey year (same as Stage 6).

6.27 Using the weights for occupied dwellings at stage 11, stage 13 derives a corresponding household weight using the household to dwelling relationship. As in stage 3, this household weight is smoothed within classes defined by region, tenure and type (house, low rise flat, high rise flat).

6.28 Stage 14 derives the final household weight by applying a scaling factor to the stage 13 household weight so that it produces the same weighted totals as the calibrated household weights from stage 12.

6.29 Stage 15 derives the final dwelling weight by applying the same (stage 14) scaling factor to the stage 11 dwelling weight for both occupied and vacant dwellings, ensuring that the final dwelling and household weights are consistent.

Calculating two year weights

6.30 Because of the smaller annual sample sizes involved, analysis of the dwelling sample is normally carried out using 2 years' weighted data. This section sets out how the combined weights were calculated.

6.31 Steps 1, 2 and 3 for the two year weights repeat stages 6, 12 and 11 respectively of the annual weighting separately for the 2011-12 and 2012-13 EHS datasets – they are individually re-calibrated to control totals as at 1 April 2012, the centre of the two survey periods.

6.32 At step 4, the individual year datasets with the re-calibrated household weights (from step 2) are merged together and a two-year household weight is created by dividing each year's weight by 2, so that each dataset has equal influence.

6.33 At step 5a, the individual year datasets with the re-calibrated dwelling weights (from step 3) are merged together and a dwelling weight is created by dividing each year's weight by 2, so that each dataset has equal influence.

6.34 At step 5b, the combined household weight (from step 4) is adjusted to take into account the new dwellings built since the time of sampling and then scaled to the original household totals.

6.35 Using the dwelling weights at step 5a, step 6 derives a household weight using the household to dwelling relationship of the combined dataset (by repeating the same process as stage 13 of the annual weighting).

6.36 Step 7 derives the final combined household weight by applying a scaling factor to the step 6 household weight so that it produces the same weighted

totals as the household weights from step5b (similar to stage 14 of the annual weighting).

6.37 Step 8 derives the final dwelling weight by applying the same (step 7) scaling factor to the dwelling weights at step 5a, for both occupied and vacant dwellings, ensuring that the final dwelling and household weights are consistent (similar to stage 15 of the annual weighting).

Application of weights during analysis

6.38 The EHS comes with its own weights covering the household and dwelling sample of cases. The weight for the household sample can be found in the file generalfs12.sav and is called agfh12. This should be used for any analysis for which the aim is to provide estimates of households, based on the interview survey data.

6.39 The weights covering the dwelling sample of cases can be found in the file general 11+12.sav. Aagpd1112 should be used for any analysis in which the aim is to provide estimates of dwellings and that includes physical survey data (e.g. percentage of non- decent dwellings) while aagph1112 should be used for any analysis in which the aim is to provide estimates of households and that includes interview survey data (e.g. percentage of households in non-decent dwellings). The weights can only be used on full 2-year datasets. They cannot be used on the data split into separate years. The recommended application of weights is summarised in Table 6.1.

Table 6.1: Application of weights during analysis

Weight	Description	Base
aagfh12	Household weight for full sample interview survey 2012-13	13,652
aagpd1112	Average dwelling weight for cases in 2011-12 and 2012-13 that had both the interview and physical survey conducted (paired cases)	12,763
aagph1112	Average household weight for cases in 2011-12 and 2012-13 that had both the interview and physical survey conducted (paired cases)	12,269

Chapter 7
Standard errors

All survey estimates are subject to sampling error, which is a measure of the uncertainty in a survey estimate because one has selected a sample of the population. This chapter presents estimates for the standard errors of key variables used in the 2012-13 EHS annual reports and provides some detail on how these errors were calculated.

Overview

7.1 Standard errors for the 2012-13 English Housing Survey were calculated on weighted data using Stata. Several factors of the design impact on the sample errors: weighting, clustering and stratification.

Sources of error in surveys

7.2 Survey results are subject to various sources of error. The total error in a survey estimate is the difference between the estimate derived from the data collected and the true value for the population. There are two main types of error: systematic and random error.

Systematic error

7.3 Systematic error, or bias, covers those sources of error which will not average to zero over repeats of the survey. Bias may occur, for example, if a certain section of the population is excluded from the sampling frame, because non-respondents to the survey have different characteristics to respondents, or if interviewers systematically influence responses in one way or another. When carrying out a survey, substantial efforts are put into the avoidance of systematic errors but it is possible that some may still occur.

Random error

7.4 The most important component of random error is sampling error, which is the error that arises because the estimate is based on a random sample rather than a full census of the population. The results obtained for any single sample may, by chance, vary from the true values for the population but the variation would be expected to average to zero over a number of repeats of

the survey. The amount of variation depends on the size of the sample, the sample design and the weighting methodology.

7.5 Random error may also result from other sources such as variations in respondents' interpretation of the questions, or variations in the way different interviewers ask questions. Efforts are made to minimise these effects through pilot work and interviewer training.

Standard errors for complex sample designs

7.6 Several factors of the design impact on the sample errors: weighting, clustering and stratification. In considering the reliability of estimates, standard errors calculated on the basis of a simple random sample design will not reflect the true variation because of the complex sample design.

7.7 Weighting for different sampling probabilities and different response rates results in larger sampling errors than for an equal-probability sample without weights. However, using population totals to control for differential non-response tends to lead to a small reduction in the errors. The method used to calculate the sampling errors correctly allows for the inflation in the sampling errors caused by the first type of weighting but, in treating the second type of weighting in the same way as the first, incorrectly inflates the estimates further. Therefore the standard errors and design factors (defts) presented in the tables below are likely to be slight over-estimates. Weighted data were used so that the values of the percentages and means were the same as those in the EHS annual reports.

7.8 The EHS uses a two-stage stratified sample design. The two-stage sample of addresses can lead to an increase in standard error if the households or individuals within primary sampling units (PSUs) are relatively homogenous but the PSU means differ from one another. Each year of the EHS covers half of the PSUs in England, so the loss in precision from clustering should be fairly small. Because alternative halves are used each year, the sample combining two years of data is, in fact, unclustered.

7.9 Stratification tends to reduce standard error and is of most advantage where the stratification factor is related to the characteristics of interest on the survey.

Design factors

7.10 The design factor, or deft, is the ratio of the standard error of an estimate from a complex sample to the standard error that would have resulted had the survey design been a simple random sample of the same size. The size of the design factor depends on the degree to which a characteristic is: clustered

within PSUs, varies across the strata and is correlated with the weights. Design factors below 1.0 show that the complex sample design improved on the estimate that would have expected from a simple random sample, probably due to the benefits of stratification. Design factors greater than 1.0 show less reliable estimates than might be gained from a simple random sample, due to the effects of clustering and weighting.

7.11 The design factors for selected survey estimates are shown in the tables below. These can be used to estimate likely sampling errors for other variables on the basis of their similarity to one of the variables presented. The standard error (se) of a proportion (p) based on a simple random sample (srs) multiplied by the deft gives the standard error of a complex design.

$$se(p) = deft \times se(p)_{srs}$$

where:

$$se(p)_{srs} = \sqrt{\frac{p(100-p)}{n}}$$ [1]

7.12 The formula to calculate the standard error of the difference between two percentages for a complex sample design is:

$$se(p_1 - p_2) = \sqrt{\frac{deft_1^2(p_1(100-p_1)}{n_1} + \frac{deft_2^2(p_2(100-p_2)}{n_2}}$$

7.13 Where p_1 and p_2 are observed percentages for the two subsamples and n_1 and n_2 are the subsample sizes.

Confidence intervals

7.14 Although the estimate produced from a sample survey will rarely be identical to the population value, statistical theory allows us to measure the accuracy of any survey result. The standard error can be estimated from the values obtained for the sample and allows the calculation of confidence intervals, which indicate the range of random variation in the survey estimates.

7.15 It is common, when quoting confidence intervals, to refer to the 95% confidence interval around a survey estimate. This is calculated at 1.96 times the standard error on either side of the estimated percentage or mean since, under a normal distribution, 95% of values lie within 1.96 standard errors of

[1] The precise formula uses *n-1* as the denominator but this equates to *n* in large samples.

the mean value. If it were possible to repeat the survey under the same conditions many times, 95% of these confidence intervals would contain the population values.

7.16 The 95% confidence interval for the difference between two percentages is given by:

$$p_1 - p_2 \pm 1.96 \times se(p_1 - p_2)$$

7.17 If this confidence interval includes zero then the hypothesis that the two proportions are the same and the observed difference is due to chance alone is not rejected. If the interval does not include zero then it is unlikely (less than five per cent probability) that the observed difference could have occurred by chance and this constitutes a 'significant difference' at the 95% confidence level.

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